The world's most comprehensive encyclopedia of the military weapons of the 20th century

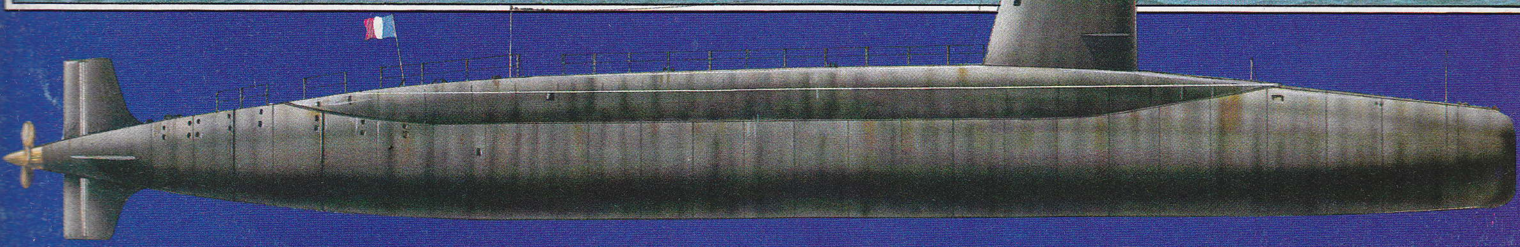
WAR MACHINE

An ORBIS Publication

77

80p

IR £1 Aus $1.95 NZ $2.25 SA R1.95 Sing $4.50 USA & Can $1.95



Armed Forces of the World: British Army (Part 4)

Sub Patrol

Soviet Submarines in Action

Missile Submarine Development

A fully illustrated guide to Modern Missile Submarines

WAR MACHINE

Volume 7 **Issue 77**

Published by
Orbis Publishing Ltd
© Aerospace Publishing Ltd 1985

Editorial Offices
War Machine
Aerospace Publishing Ltd
179 Dalling Road
London W6 0ES

Managing Editor: Stan Morse
Editorial: Trisha Palmer
Chris Bishop
Chris Chant
Ian Drury

Design: Rod Teasdale
Colour Origination: Imago Publishing Ltd, Thame, Oxon

Typesetting: SX Composing Ltd

Film work: Precise Litho Ltd

Artists:
Tony Gibbons
John Ridyard

21852

Printed in Great Britain
by The Artisan Press Ltd

Subscription Manager: Christine Allen
0488 72666

Consultant Editor: Major General Sir Jeremy Moore KCB OBE MC, Commander of British Land Forces during the Falklands campaign.

Distribution and marketing offices:
Orbis Publishing Ltd
Orbis House
20-22 Bedfordbury
London WC2N 4BT
Telephone: 01-379 6711
Circulation Director: David Breed
Marketing Director: Michael Joyce

WAR MACHINE

Forthcoming issues feature:
Modern 1.5 to 5 Ton Trucks
Self-Propelled Guns of World War II
Carrier Aircraft of World War II
Early Missiles

Picture acknowledgements

Cover photograph: US Navy. **1521:** US Navy/US Navy. **1522:** SIRPA. **1523:** SIRPA/SIRPA. **1524:** US Navy/US Navy. **1525:** US Navy/US Navy. **1526:** US Navy. **1527:** US Department of Defense. **1528:** US Navy/US Department of Defense. **1529:** US Navy/US Department of Defense. **1530:** US Department of Defense. **1532:** US Navy. **1533:** US Navy. **1536:** US Navy/US Navy/US Navy/US Navy. **1537:** US Navy. **1538:** US Navy. **1539:** Royal Navy Fleet Photographic Unit/British Aerospace. **1540:** US Navy. **(iii):** Bob A. Munro/Westland Helicopters. **(iv):** MoD/COI/COI.

HOW TO OBTAIN ISSUES AND BINDERS FOR WAR MACHINE

Issues can be obtained by placing an order with your newsagent or direct from our Subscription Department. If you have difficulty obtaining any back issues from your newsagent, please write to us stating the issue(s) required and enclosing a cheque for the cover price of the issue(s).

AUSTRALIA please write to: Gordon and Gotch (Aus) Ltd, 114 William Street, PO Box 767G, Melbourne, Victoria 3001. MALTA, NEW ZEALAND, SINGAPORE & SOUTH AFRICA: Back numbers are available at cover price from your newsagent. In case of difficulty, write to the address given for binders.

UK/EIRE
PRICE: 80p/IR£1
SUBSCRIPTION:
6 Months: £23.92
1 Year: £47.84
BINDER: Please send £3.95 per binder, or take advantage of our special offer in early issues.

EUROPE
PRICE: 80p
SUBSCRIPTION:
6 Months air: £42.12
surface: £33.54
1 Year air: £84.24
surface: £67.08
BINDER: £5.00
AIRMAIL: £5.50

MALTA
Obtain BINDERS from
your newsagent or
Miller (Malta) Ltd,
MA Vassalli Street,
Valetta, Malta
Price: £3.95

MIDDLE EAST
PRICE: 80p
SUBSCRIPTION:
6 Months air: £44.98
surface: £42.12
1 Year air: £89.96
surface: £84.24
BINDER: £5.50
AIRMAIL: £8.30

AMERICAS/ASIA/AFRICA
PRICE: US$1.95/80p
SUBSCRIPTION:
6 Months air: £53.30
surface: £42.12
1 Year air: £106.60
surface: £84.24
BINDER: £5.50
AIRMAIL: £9.50

SOUTH AFRICA
PRICE: R1.95
Obtain BINDERS from
any branch of Central
News Agency or
Intermag, PO Box
57394, Springfield
2137

SINGAPORE
PRICE: Sing$4.50
Obtain BINDERS from
MPH Distributors
601 Sims Drive
03-07-21
Singapore 1438

AUSTRALASIA/FAR EAST
PRICE: 80p
SUBSCRIPTION:
6 Months air: £57.46
surface: £42.12
1 Year air: £114.92
surface: £84.24
BINDER: £5.50
AIRMAIL: £10.00

AUSTRALIA
PRICE: AUS$1.95
Obtain BINDERS from
First Post Pty Ltd,
23 Chandos Street
St Leonards,
NSW 2065

NEW ZEALAND
PRICE: NZ$2.25
Obtain BINDERS from
your newsagent or
Gordon & Gotch (NZ)
Ltd, PO Box 1595,
Wellington

ADDRESS FOR BINDERS AND BACK ISSUES
Orbis Publishing Limited
Orbis House
20-22 Bedfordbury
London
WC2N 4BT
Telephone: 01-379-5211

Cheques/Postal Orders should be made payable to Orbis Publishing Limited. Binder prices include postage and packing and prices are in sterling.

Back Issues are sold at the cover price, and we do not charge carriage in the UK.

NOTE
Binders and back issues are obtainable subject to availability of stocks. Whilst every attempt is made to keep the price of the issues and binders constant, the publishers reserve the right to increase the stated prices at any time when circumstances dictate. Binders depicted in this publication are those produced for the UK and Australian markets only. Binders and Issues may be subject to import duty and/or local taxes, which are not included in the above prices unless stated.

ADDRESS FOR SUBSCRIPTIONS
Orbis Publishing Limited
Hurst Farm
Baydon Road
Lambourne Woodlands
Newbury
Berks
RG16 7TW
Telephone: 0488-72666

All cheques/Postal Orders should be made payable to Orbis Publishing Limited. Postage and packaging is included in subscription rates, and prices are given in Sterling.

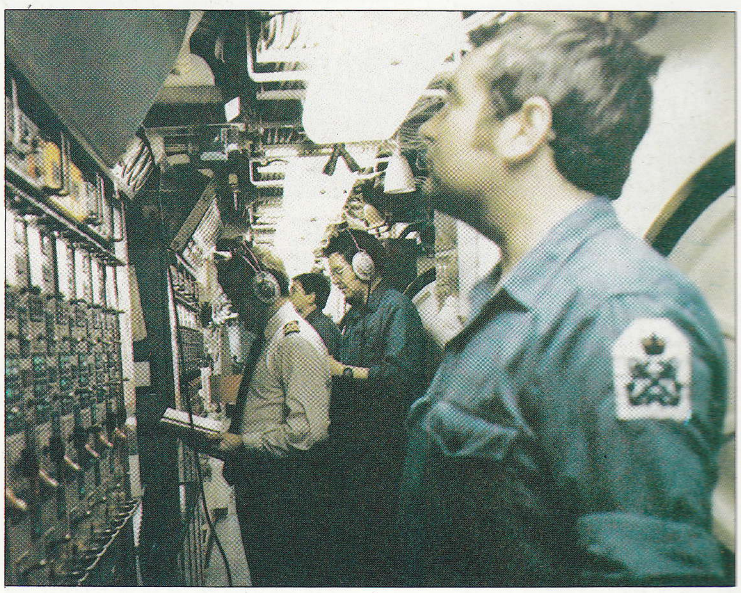
Modern Missile Submarines

Silently through the depths, the most menacing leviathans the world has known make their stealthy way. For months at a time the missile-carrying submarines of five nations patrol the seas, their awesome destructive power concealed and protected by the vast spaces and depths of the ocean.

The nuclear-powered ballistic missile submarine (SSBN) and the submarine-launched ballistic missile (SLBM) have become the shield of both the Eastern and Western power blocs. With vast areas of the world's oceans to roam on long lonely submerged patrols, the boats provide an almost totally immune second-strike capability against the opposing bloc's population centres and industrial targets and so keeps the possibility of a first strike well in check.

The resources required to finance, build, outfit and maintain in service such a force mean that only a handful of countries can afford to operate these vessels. The largest operator by far is the Soviet Union which, after 20 or so years, has at last outstripped the USA in terms of total force levels and capabilities, with around 62 SSBNs of six different classes in service. The Americans by contrast now field only 36 of three different classes. The Soviets also have five different missile types to the Americans' two, although the latter still lead in overall numbers of warheads carried. To back up the Americans in NATO and to provide an independent deterrent, the UK maintains one of its four Polaris-equipped SSBNs on patrol continuously, whilst France remains outside the NATO organization but still deploys one or two of her six-vessel SSBN force as part of her national strategic deterrent. In a bid to counter both major superpowers the People's Republic of China became the fifth SSBN operator recently when she deployed the first of at least four 'Xia' class SSBNs with an indigenously designed and built SLBM fitted with a thermonuclear warhead.

The missile control section aboard a British 'Resolution' class submarine does not look particularly dramatic, but in dozens of such places below the sea similar crews stand ready to unleash their mighty charges, hoping that they never have to put their equipment to the ultimate test.

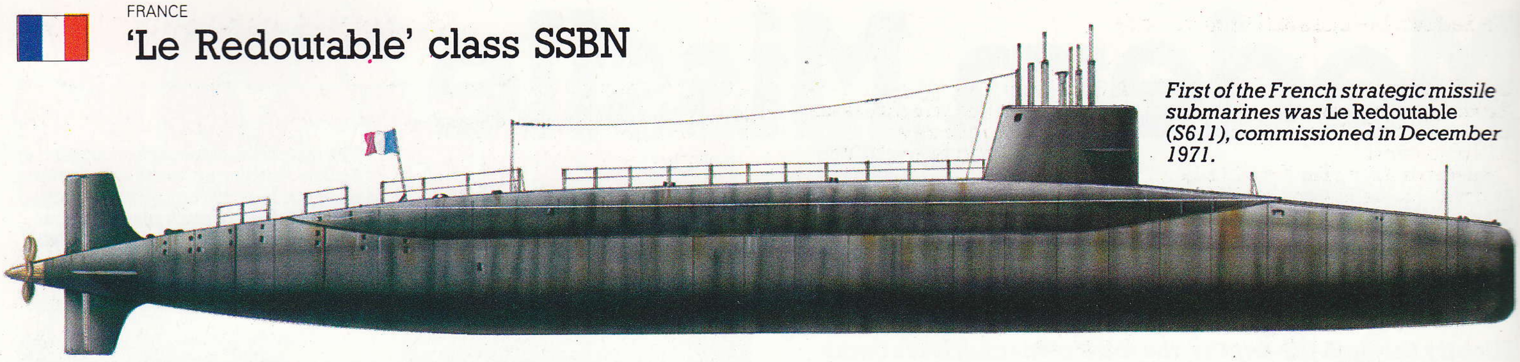


Because of this type of submarine's relative invulnerability to ASW countermeasures, it is expected that such boats will be around for many decades to come, although possibly in modified form as new missile types and defences evolve.

Larger than most cruisers of World War II, the current generation of ballistic missile submarines as represented by the massive USS Ohio *are without parallel in their frightening destructive might.*

FRANCE

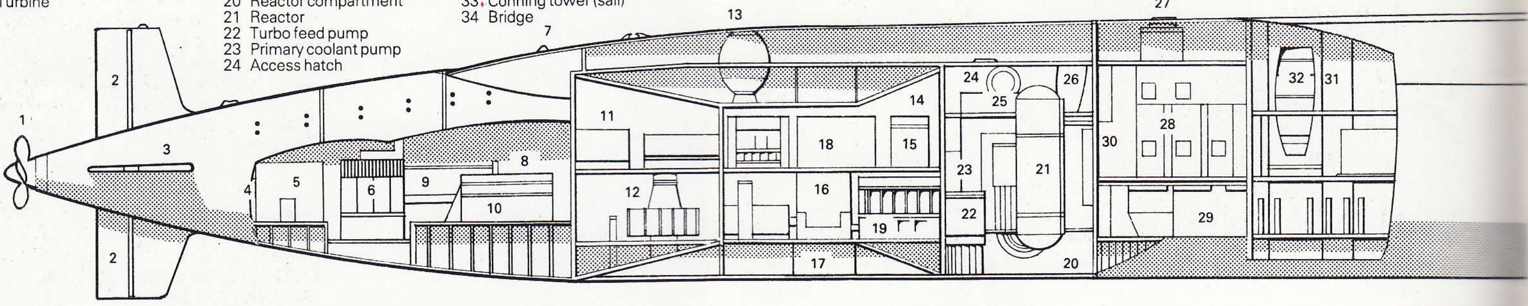
'Le Redoutable' class SSBN



First of the French strategic missile submarines was Le Redoutable *(S611), commissioned in December 1971.*

Le Redoutable cutaway drawing key

1 Single screw
2 Rudder
3 Hydroplane
4 Engine thrust block
5 Propulsion motor
6 Battery drive controller
7 Flagstaff holder
8 Main engine room
9 Gearbox
10 Turbine
11 Air conditioning plant
12 Main condenser
13 Aft escape hatch
14 Diesel generating room
15 Control panel
16 Turbo generator
17 Ballast
18 Motor generator
19 Motor driven feed pump
20 Reactor compartment
21 Reactor
22 Turbo feed pump
23 Primary coolant pump
24 Access hatch
25 Access door
26 Tunnel
27 Loading hatch
28 Switchboard room
29 Pump room
30 Bulkhead
31 Missile tube
32 MSBS M20 submarine-launched ballistic missile
33 Conning tower (sail)
34 Bridge
35 Surface navigation platform
36 Whip aerial
37 Diesel exhaust
38 EW (Electronic Warfare) mast
39 Snorkel
40 Radar mast
41 Periscopes
42 Directional antennae
43 Control room hatch
44 Central control position
45 Control console
46 Galley
47 Crew quarters
48 Wardroom
49 Galley
50 Sonar control
51 Junior mess hall
52 Pressure hull
53 Stores
54 Batteries
55 Battery covers
56 Forward escape hatch
57 Pump
58 Torpedo room
59 Spare torpedo
60 Torpedo tubes
61 Torpedo ports
62 Compressed air flasks
63 Access tube to conning tower



The first French SSBN (or more correctly Sous-Marin Nucléare Lance-Engine or SNLE) ***Le Redoutable*** (S611) was authorized in March 1963, laid down in November 1964 and commissioned in 1971 after being employed for 2½ years on trials as the prototype for the French naval deterrent known as the Force de Dissuasion in official circles. She and her **'Le Redoutable' class** sistership ***Le Terrible*** (S612) were initially equipped with the 2400-km (1,490-mile) range two-stage solid-propellant inertially-guided M1 SLBM that had a single 500-kiloton thermonuclear warhead and a CEP of 930 m (3,050 ft). In 1974 the third unit, ***Le Foudroyant*** (S610), was commissioned with the improved 3100-km (1,925-mile) range M2 missile with a more powerful second-stage motor but carrying the same warhead and having a similar CEP. The two previous vessels were then retrofitted with the M2 system during their normal overhauls. The fourth boat, ***L'Indomptable*** (S613), was commissioned into service in 1977 with the vastly improved M20 missile that has the same range and accuracy as the M2 but carries a new 1.2-megaton yield specially hardened warhead with what is believed to be chaff dispensing penetration aids to confuse defending radar systems. The last vessel, ***Le Tonnant*** (S614), was also completed with the M20 whilst the three units equipped with the M2 have now been brought up to the same standard. From 1985 the last four units built will undergo yet another modification to carry the M4 SLBM that is due to enter service in January of that year aboard *L'Inflexible*. All five boats are to be converted to carry the underwater-launched SM.39 Exocet anti-ship missile and the sonars of *L'Inflexible*. The planned deletion dates for the class are S611 1997, S612 1999, S610 2002, S613 2004 and S614 2008.

Le Foudroyant *(S610) and her sister-ships were designed and built in France without any help from the Americans, unlike the British Polaris boats, which required considerable design assistance.*

FRANCE

'L'Inflexible' class SSBN

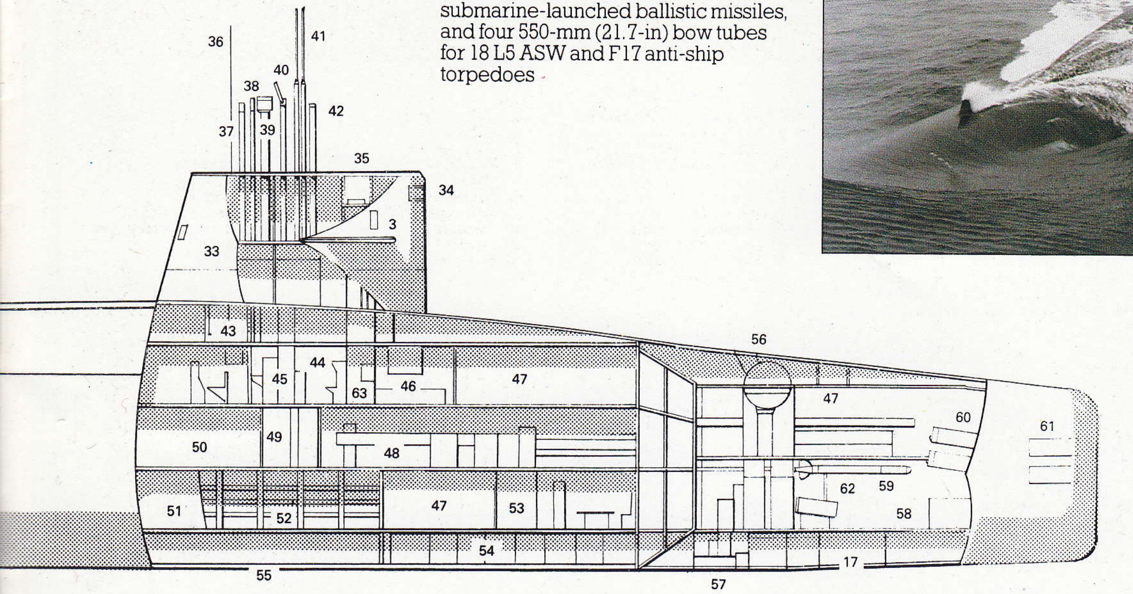
Ordered in September 1978, the sole **'L'Inflexible' class** boat ***L'Inflexible*** (S615) is to be an intermediate design between the 'Le Redoutable' class and a new class of 14,000-15,000 tons planned to be operational around 1993-4. She will retain most of the external characteristics of the earlier class, but the internal fittings and sensors will differ by taking advantage of the advances made in the propulsion system, electronics and weapons since the 'Le Redoutable' class boats were constructed. The rationale behind this intermediate boat lies in the fact that France requires three SSBNs to be continuously available, of which two are to be on patrol. In order to achieve this the French navy has to have six submarines in service, a number one more than the 'Le Redoutable' class total.

Laid down in March 1980, *L'Inflexible* will achieve operational status in January 1985 and is not due for deletion until 2012. Like all French missile submarines, she will have two crews, Bleu (blue) and Ambre (amber), to crew the vessel in rotation in order to maximize the time spent on patrol between reactor-refuelling refits. French SSBNs normally undertake patrols of two months' duration, with three months as the absolute maximum. All the vessels are based at Ile Longue near Brest and have special protection when transiting to and from the port. This includes the French navy's sole Aérospatiale SA 321G Super Frelon ASW helicopter unit, Flottille 32F, which operates in groups of up to four helicopters to screen the boats, one helicopter dunking its sonar whilst the others stand back ready to attack if required.

Specification

'L'Inflexible' class
Displacement: 8,080 tons surfaced and 8,920 tons dived
Dimensions: length 128.7 m (422.2 ft); beam 10.6 m (34.8 ft); draught 10.0 m (32.8 ft)
Propulsion: one pressurized water-cooled reactor powering two steam turbines driving one shaft
Speed: 18 kts surfaced and 25 kts dived
Diving depth: 350 m (1,150 ft) operational and 465 m (1,525 ft) maximum
Armament: 16 launch tubes for 16 M4 submarine-launched ballistic missiles, and four 533-mm (21-in) bow tubes for 14 L5 ASW and F17 anti-ship torpedoes plus four SM.39 Exocet anti-ship missiles
Electronics: one surface-search radar, one passive ESM system, one DLT D3 torpedo and Exocet fire-control system, one DSUX 21 sonar, and one DUUX 5 underwater telephone
Complement: 135

Specification
'Le Redoutable' class
Displacement: 8,045 tons surfaced and 8,940 tons dived
Dimensions: length 128.7 m (422.2 ft); beam 10.6 m (34.8 ft); draught 10.0 m (32.8 ft)
Propulsion: one pressurized water-cooled reactor powering two steam turbines driving one shaft
Speed: 18 kts surfaced and 25 kts dived
Diving depth: 250 m (820 ft) operational and 330 m (1,085 ft) maximum
Armament: 16 launch tubes for 16 M20 submarine-launched ballistic missiles, and four 550-mm (21.7-in) bow tubes for 18 L5 ASW and F17 anti-ship torpedoes



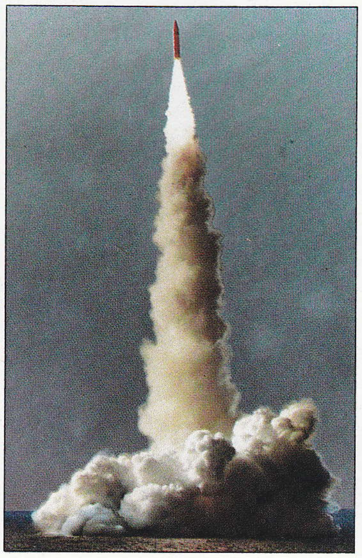
Above: The French try to maintain a minimum of two SNLEs on patrol at any one time, with submarines such as Le Terrible *(S612) being screened on departure and return by French navy surface units, submarines and ASW aircraft in order to maintain security.*

Electronics: one Calypso surface-search radar, one DLT D3 torpedo fire-control system, one passive ESM system, one DSUV 23 sonar, and one DUUX 2 underwater telephone
Complement: 135

FRANCE

M20 SLBM

The **Mer-Sol Balistique Stratégique M20** is essentially a variant of the earlier two-stage M2 with the Rita 11/P6 second stage converted to carry a single re-entry vehicle (RV) with an MR60 1.2-megaton yield thermonuclear warhead and associated penetration aids. Since initial deployment in 1977 aboard *L'Indomptable*, the missile has been refitted to carry the lighter but similar-yield MR61 warhead. Both types were specially hardened to resist damage from the electromagnetic pulse (EMP) and fast radiation produced when nuclear-tipped anti-ballistic missiles (from systems such a the ABM-1 'Galosh' network around Moscow) explode in their vicinity. The M20 is ejected by compressed air, and is the culmination of a missile programme that started design development in 1959 and entered operational service as the MSBS M1 in 1971. The development progressed through the uprated M2 that entered service in 1974 to the present M20. The whole 16 M20 missile outfit of a French SSBN can be launched within 15 minutes. From 1985 the M20 missile will be replaced aboard the last four of the 'Le Redoutable' class by the M4, which is virtually a new design for a MIRV payload. The last M20 missiles, however, will not be phased out until *Le Redoutable* herself is paid off in 1997.



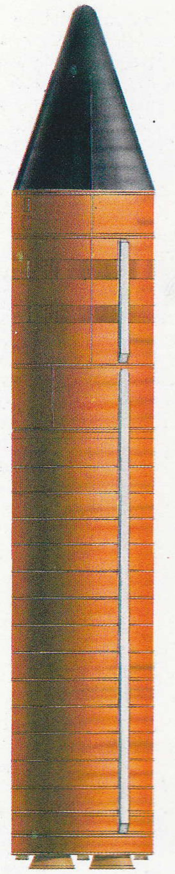
Although due to be eventually superseded by the M4, the M20 remains in service aboard the 'Le Redoubtable' class. It is armed with a 1.2-megaton yield thermonuclear warhead that is specially hardened against the effects of defensive ABM nuclear weapon systems.

Specification
M20
Type: submarine-launched ballistic missile
Dimensions: length 10.4 m (34.1 ft); diameter 1.5 m (4 ft 11 in)
Launch weight: 20054.6 kg (44,213 lb)
Performance: range 3100 km (1,926 miles); CEP 930 m (1,017 yards)
Warhead: one re-entry vehicle with an MR61 1.2-megaton weapon and penetration aids
Propulsion: solid-propellant rocket
Guidance: inertial

FRANCE

M4 SLBM

Destined to attain operational capability with *L'Inflexible* in 1985, the **Mer-Sol Balistique Stratégique M4** was tested at sea in early March 1982 from the experimental missile submarine *Gymnote*. The design of the missile was started in 1976, and the missile was fired for the very first time from a land-based test pad in November 1980. The three-stage solid-propellant weapon has a payload of six 150-kiloton yield multiple independent re-entry vehicles (MIRVs) of greater circular error probability (CEP) accuracy than previous French single-warhead SLBMs, with the added advantage of advanced penetration aids to defeat enemy ballistic missile defences. The interval between missile launchings is also shorter, and the possible launch depth is greater as a result of the use of powder charge injection, thus significantly improving the launch platform's survivability factor. All the French navy SSBNs except *Le Redoutable* are due to have the M4 retrofitted from 1985, and will thus have extensive modifications to their launch tubes, together with new fire-control and missile tube ejector systems. The refit schedule will be in the order *Le Terrible*, *Le Foudroyant*, *L'Indomptable* and *Le Tonnant*, and is to be part of the boats' normal overhaul cycles.



The M4 SLBM is due to enter service in early 1985 aboard the SNLE L'Inflexible *(S615). The new missile has a longer range than previous French SLBMs.*

Specification
M4
Type: submarine-launched ballistic missile
Dimensions: length 11.05 m (36.25 ft); diameter 1.92 m (6 ft 3.6 in)
Launch weight: 35073.2 kg (77,323 lb)
Performance: range 4000 km (2,485 miles); CEP 460 m (503 yards)
Warhead: six 150-kiloton MIRVs
Propulsion: solid-propellant rocket
Guidance: inertial

Missile Submarine Development

With a genesis reaching back to German plans of World War II, the concept of the missile-armed submarine is not new. Both the American and Soviet navies made use of captured German technology in the post-war years, but it was in the 1950s that the modern conception of the nuclear-powered, nuclear-missile-armed submarine arose.

Although the precise origins of the American submarine-launched strategic missile programme cannot be traced, it is known that on 5 March 1946 the Chief of Naval Operations ordered the conversion of two World War II fleet submarines, the USS *Cusk* and USS *Carbanero*, to carry and fire two of the air-breathing Loon missiles which had been derived from the German V-1. At the same time as the first successful Loon was launched in March 1947 from the *Cusk*, development programmes for two indigenous long-range submarine bombardment missiles were in progress; these became the Rigel and Regulus. The former was subsequently cancelled in 1953 because of launcher problems, but in the year previous the fleet submarine USS *Tunny* had been converted to carry two Regulus I missiles, which could be fired from the surfaced submarine. An additional unit, the USS *Barbero*, was later converted along the same lines, and two more units, the USS *Grayback* and USS *Growler*, were completed on the stocks as missile launchers but with capacity for four missiles.

Nuclear power

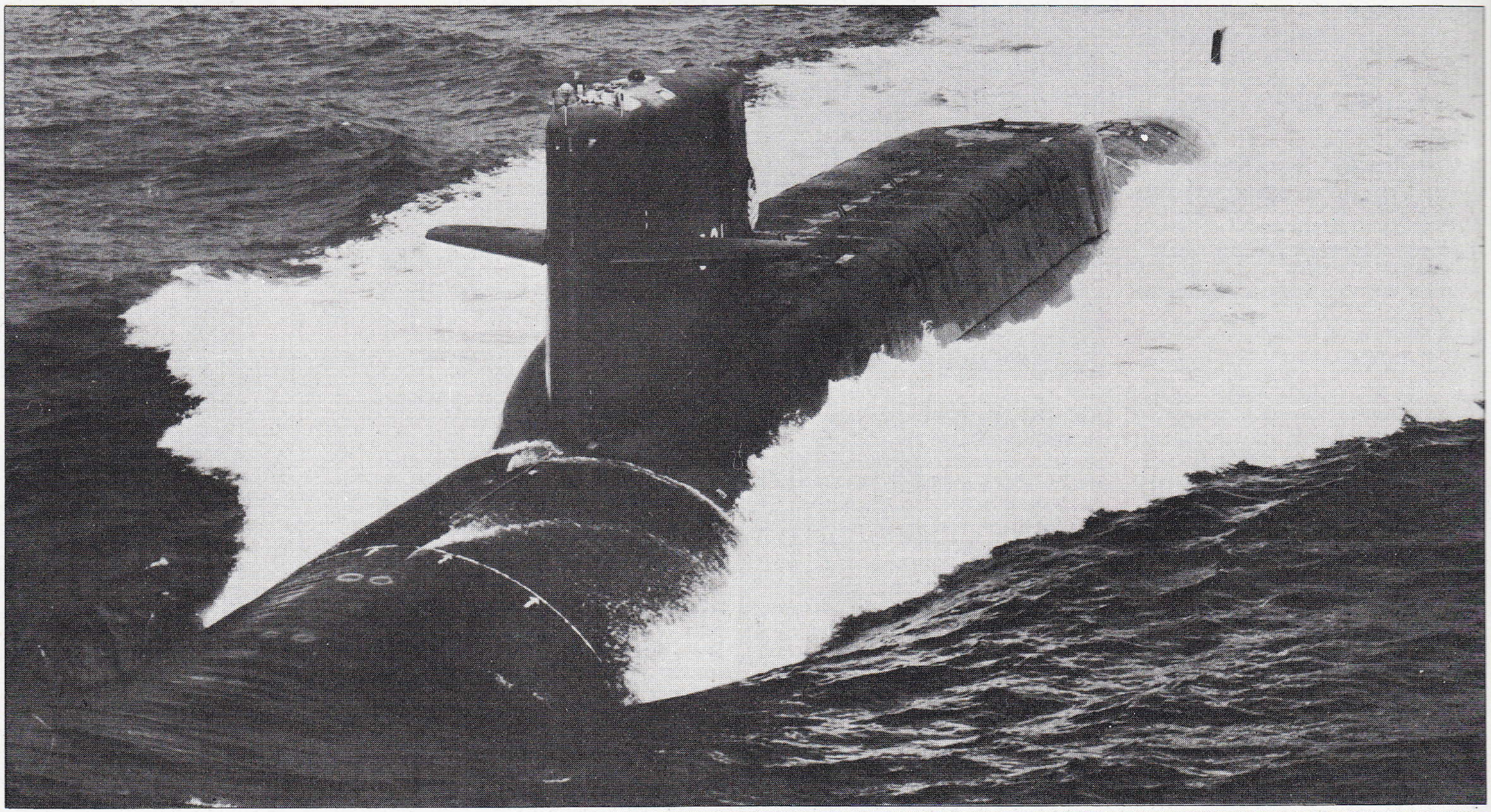
With the advent of the nuclear reactor for submarine propulsion a further conventional boat, the USS *Halibut*, which had been ordered as a Regulus carrier, was reordered in 1956 with the new propulsion system and the ability to carry five missiles. She was to have been followed by a class of even larger nuclear-powered submarines each carrying four of the larger supersonic Regulus II follow-on missiles. But in 1958 this new missile was cancelled and the submarines reordered as attack units.

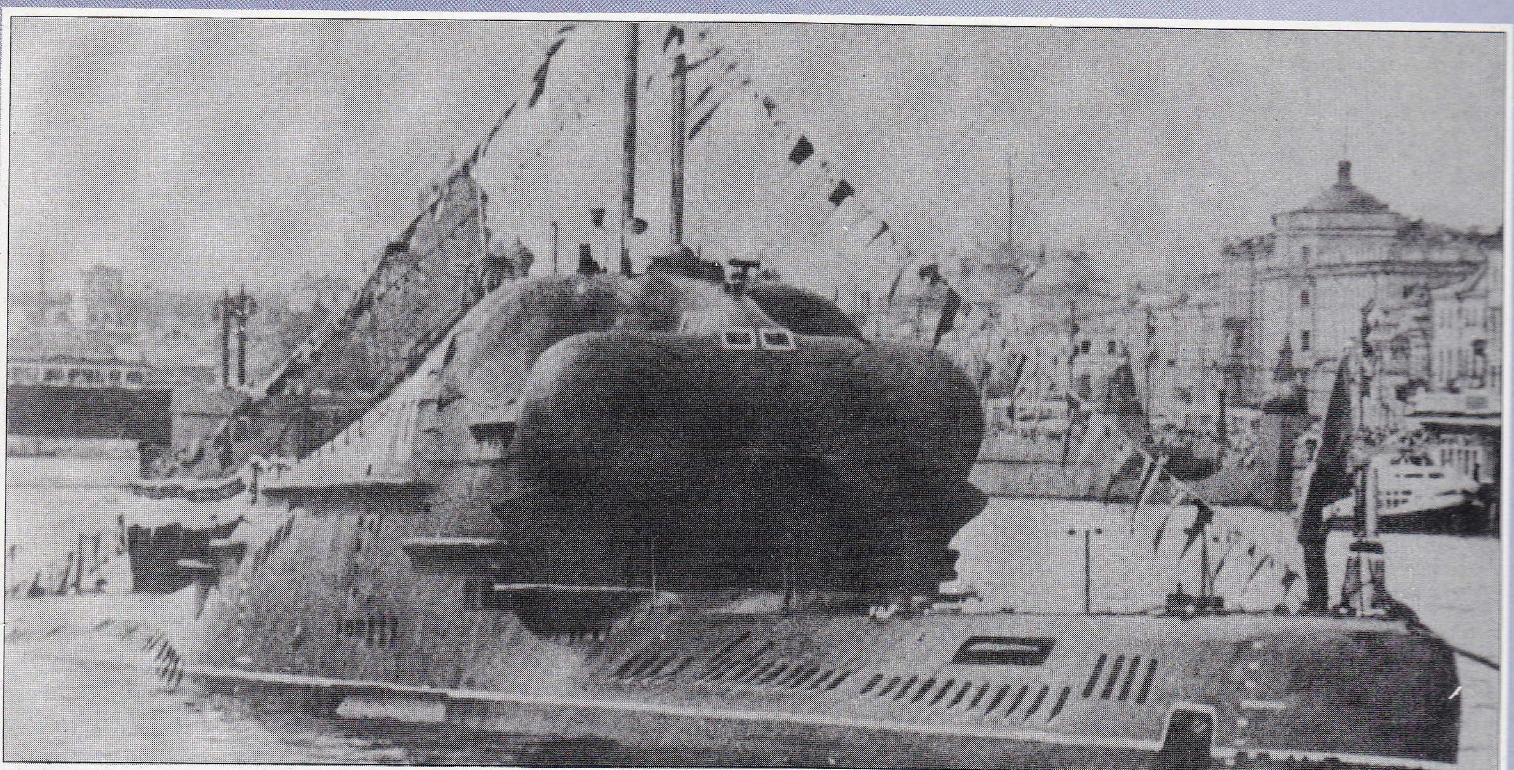
Soviet systems

The Regulus II had fallen foul of the Polaris ballistic missile. Evolved during the mid-1950s, this new type of underwater-launched missile required a projected force level of 30 submarines to be on station from a total of 45-50 units. To accommodate the 2220-km (1,380-mile) range interim Polaris A1 model a crash conversion programme was initiated in the late 1950s to install a 39.6-m (130-ft) long section for 16 missiles abaft the fin in the hulls of six 'Skipjack' class attack submarines to produce the 'George Washington' SSBN class. As these vessels were being launched so the six 'Ethan Allen' class vessels, designed from the keel up as SSBNs, were laid down. These were in effect ballistic missile versions of the contemporary 'Thresher' class SSNs and made effective use of that type's superior machinery-silencing techniques and deeper diving hull materials. Equipped with the Polaris A2 SLBMN they were rapidly followed down the production line by the still larger 31-strong 'Lafayette' and 'Benjamin Franklin' classes of SSBNs, the last 23 of which commissioned into service carrying the Polaris A3 missile. When the first Pacific Fleet SSBN carried out its first patrol at the end of 1964 so the five Regulus I submarines were phased out after seven years of patrols in the area. All of the 41 Polaris-equipped vessels were completed between 1959 and 1964, which still ranks as one of the major industrial and military achievements of recent times in

One of the first launches of Polaris A3, in 1964, signalled the culmination of the astonishing scientific and industrial achievement which marked the Polaris programme. In the space of five years the USA had built 41 boats and established a strategic advantage over the USSR that was to last into the 1980s.

Now deactivated, the USS Robert E. Lee *(SSBN601), with four sister ships, comprised the 'George Washington' class of SSBNs that was converted from the 'Skipjack' class attack submarine design to give the world's first true ballistic missile submarines.*





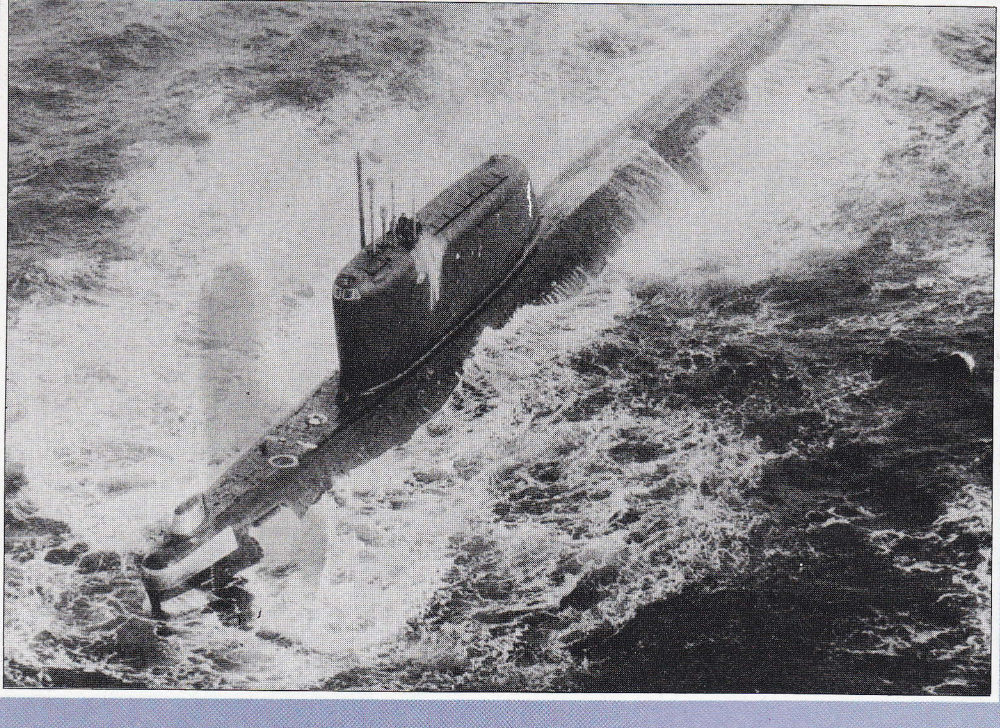
The follow-on class to the Soviet 'Twin Cylinder' conversions was the 'Whiskey Long Bin' type. This involved lengthening the hull and inserting a section into the sail to carry four SS-N-3C 'Shaddock' strategic cruise missile container-launchers at a fixed angle of 15 degrees.

the Western world.

Meanwhile, in the Soviet Union during the 1950s the leadership, under Khrushchev after the death of Stalin, elevated Admiral Gorshkov to the navy commander-in-chief's post with the directive to build new missile-armed submarines and surface ships to defend the Soviet homeland. Before 1956, when Gorshkov became C-in-C, the Soviets had already had in development a submarine ballistic missile programme based on technology captured from the Germans at the end of World War II. This culminated in September 1955 when a conventionally armed R-11FM missile derived from the Soviet army's 'Scud' tactical ballistic missile was launched from a converted 'Zulu' class conventional submarine. This was followed by five further 'Zulu V' conversions (1956-8, each with two missiles) and the 23 specially built Project 629 (built 1958-62, each with three missiles) 'Golf' class boats which carried the surface-launched R-13 (SS-N-4 'Sark') missile. In their usual manner of developing alternative strategic submarine systems the Soviets also designed and built the P-5 (SS-N-3C 'Shaddock') surface-launched inertially-guided 800-kiloton yield cruise missile which was tested in 1957 on a conventional submarine given the NATO codename 'Whiskey Single Cylinder'. This was followed by five 'Whiskey Twin Cylinder' (1959-61, each with two P-5s) and seven 'Whiskey Long Bin' (1961-5, each with four P-5s) conversions.

As these entered service so the Soviets also introduced their own nuclear-powered versions using a common design root. The SSBN class became known in the West as the 'Hotel I' (eight built 1959-62, each with three R-13s) whilst the SSGNs became the 'Echo I' (six built 1960-2, each with six P-5s). The latter was the only nuclear-powered class equipped with strategic cruise missiles because the Soviet navy was shifted from its strategic role in the early 1960s when the new land-based Strategic Rocket Forces assumed the task. Apart from deploying the submerged-launch R-21 (SS-N-5 'Serb') missile on seven of the 'Hotels' to give the 'Hotel II' subclass and on 13 of the 'Golfs' to give the 'Golf II' variant, the Soviet navy did not match the massive American SSBN build-up until the strategic role was reassigned to the navy as one of its primary roles. By this time Soviet military intelligence had obtained most of the relevant plans of the American 'Ethan Allen' class, together with British long-range sonar details. Thus in 1967 there entered service the first 'Yankee' SSBN that was very similar in appearance to the American class and equipped with a new long-range low frequency sonar of the type required for SSBN operations.

In a programme that matched America's SSBN construction rate, the Soviets built 34 units between 1967 and 1974 at two shipyards for



The first Soviet nuclear-powered ballistic missile submarine class was the 'Hotel' type. Reconfigured in the 1960s to carry the SS-N-5, these boats are now being phased out and are either being scrapped or converted to other roles such as submerged naval command posts.

eventual use off both coasts of the USA. However, because these vessels had to transit long distances through enemy-controlled waters to their patrol areas, the Soviets designed and tested new long-range SLBMs that could be fired from waters adjacent to the Soviet homeland and still hit targets in the USA. To accommodate these they simply took the 'Yankee' design and enlarged it to give the 12-tube 'Delta I' with the SS-N-8 and then the 16-tube 'Delta II' with the same missile. With MIRVing of submarine-launched missiles the Soviets again modified the 'Delta' to produce the 'Delta III' variant with 16 SS-N-18s.

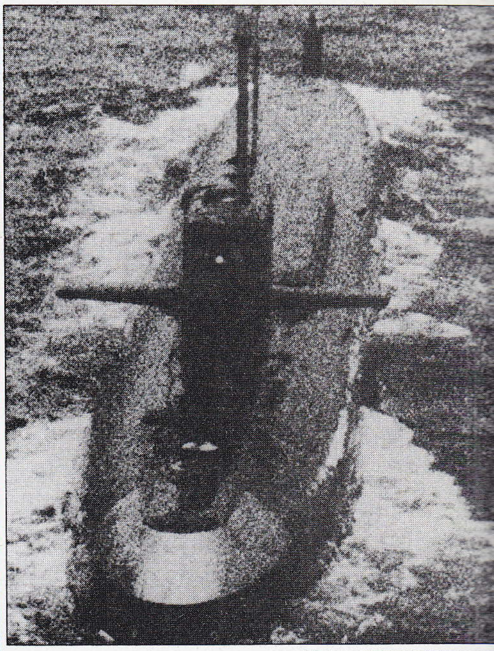
As the Soviets introduced the first of the 'Delta' series the Americans began to deploy the Poseidon MIRV-equipped SLBM aboard their last 31 SSBNs to improve force capabilities. Its follow-on, the Trident, which offers longer range, was ultimately deemed to require a new submarine design with more missile tubes to obtain greater cost effectiveness. As an interim measure 12 of the Poseidon-equipped units were converted to carry the Trident I SLBM. The result of the new design programme was the 'Ohio' class which, with 24 missile tubes for initially the Trident I and then the Trident II when it becomes available, is the West's largest SSBN and will eventually be the only type in service with the US Navy.

As soon as the Soviets learnt of the new class they began design of their own counterpart, the incredibly large 'Typhoon' class, which attained operational status in 1983. With 20 missile tubes forward of the fin for the SS-N-20, the vessel is specifically designed for operations under the Arctic ice cap, a capability which is not matched by the West. For the future the Soviets intend to introduce a new SLBM, the SS-NX-23, into service possibly on board another 'Delta' variant, whilst the Americans are still researching the possibility of procuring a cheaper SSBN than the 'Ohios' to carry the Trident II.

Polaris and Trident

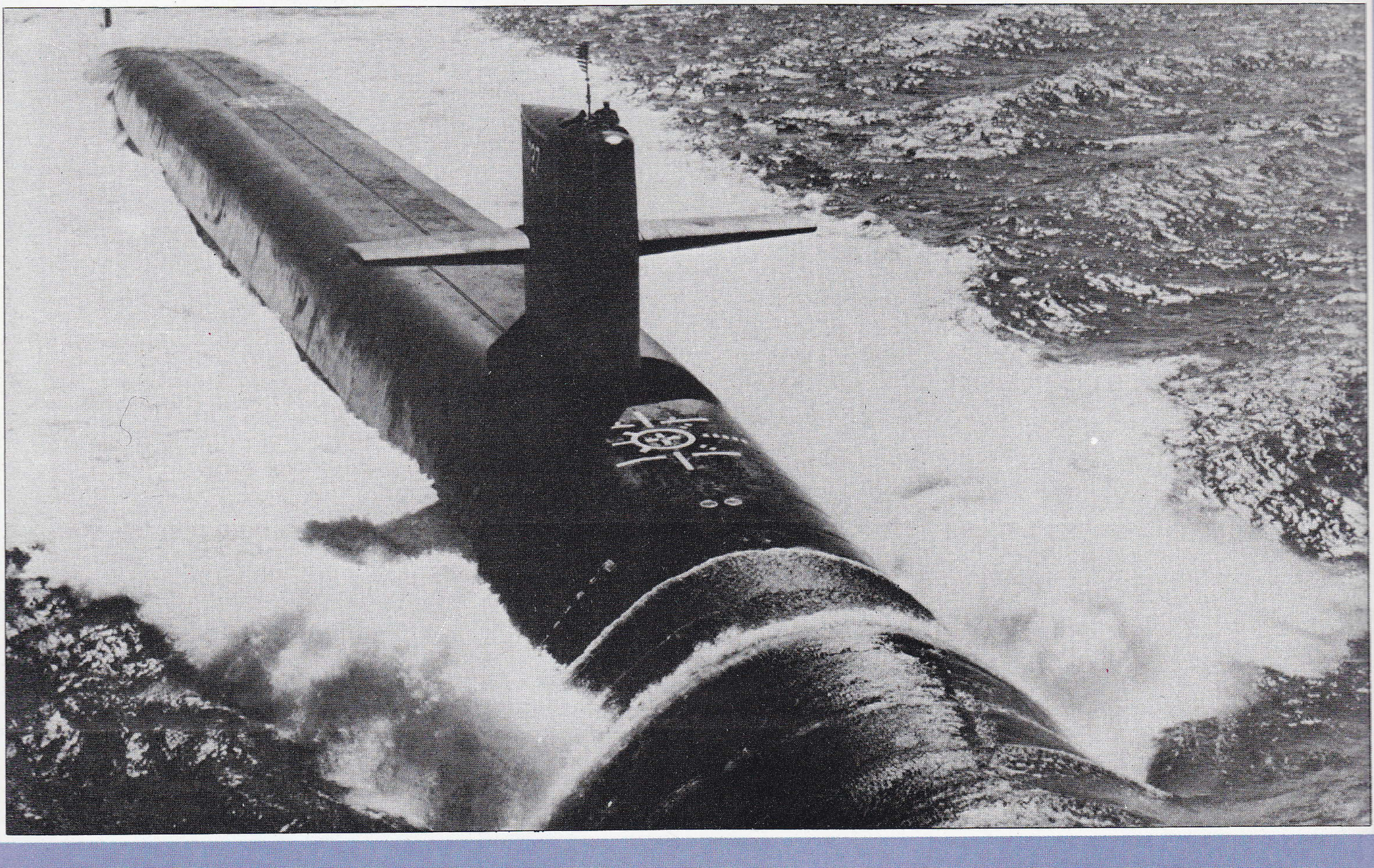
Of the other three SSBN operators, the UK built in the late 1960s the 'Resolution' class of four units with British technology but carrying the American Polaris A3 SLBM. These are due to be replaced in the mid-1990s by four 'V' class SSBNs carrying the Trident II missile system. The design will be larger than the current Polaris vessels but will have only 16 missile tubes rather than the 24 aboard comparable American submarines. France, the other European nation equipped with SSBNs, went her own way designing and building both the submarines and the missiles that they carry. The first class built was the 'Le Redoutable', the five units of which have been followed by a single interim unit, *L'Inflexible*, that is the forerunner of an entirely new design for the 1990s. More recently American intelligence has indicated that Communist China has made operational the first of the 8,800-ton 120-m (393.7-ft) long SSBNs known as the 'Xia' class. Fitted with 12 of the indigenous two-stage solid-propellant CSS-N-2 SLBM, a force of up to six units is expected to be operational by the late 1980s, targeted primarily against the Soviet Far East.

Where the SSBN goes from here is probably dependent on how successful is the development and deployment of 'Star Wars' beam and laser weapons, but what is likely is that the weapons load carried may well switch towards the strategic ultra-low-level cruise missile, with the Soviet navy probably leading the way.



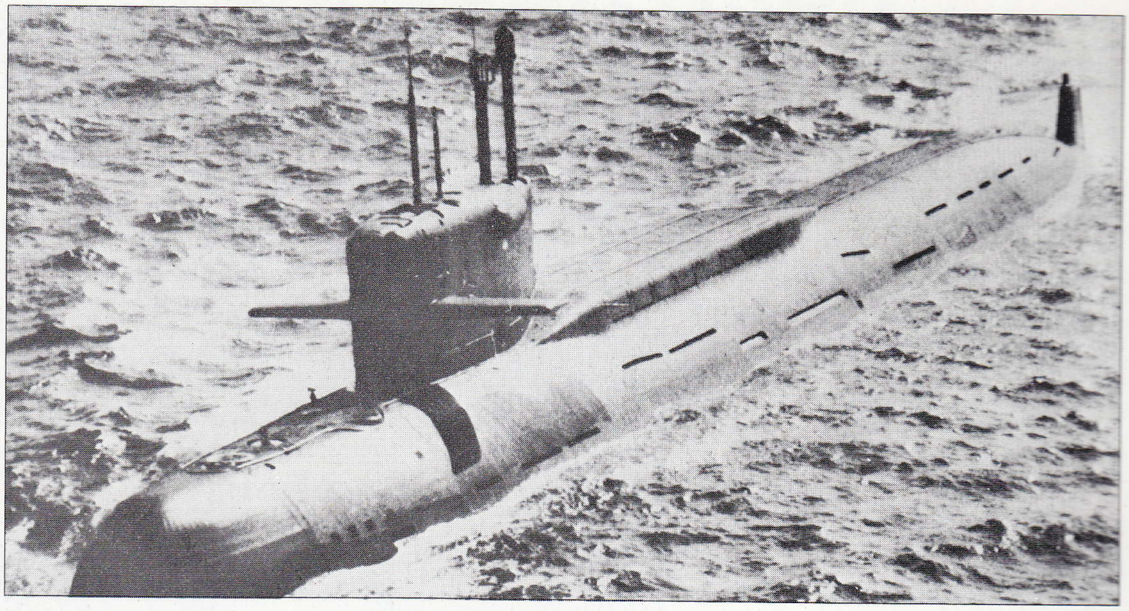
A 'Yankee I' class SSBN runs on the surface. The Soviets keep several units of this type off each coast of the United States to provide a minimum warning attack on time-sensitive targets such as Strategic Air Command bomber bases in the event of a nuclear war.

The 'Ohio' class of SSBN, much larger than its predecessors, is to be armed with the Trident II missile system. The D5 missile in that system will for the first time be accurate enough to allow submarines to attack 'hard' targets.



USSR

'Yankee' class SSBN



Apparently built with the aid of Polaris missile submarine plans stolen from the Americans, the 'Yankee I' class, with its SS-N-6 missiles, formed the major part of the Soviet SSBN fleet in the early 1970s.

The **'Yankee' class** was the first modern Soviet SSBN to be built. The design was apparently based on the plans of the US 'Benjamin Franklin' and 'Lafayette' classes that were covertly obtained by Soviet military intelligence (GRU) in the early 1960s. Thirty-four units were built between 1967 and 1974 at the shipyards in Severodvinsk and Komsomolsk, the peak year being 1970 when 10 vessels were completed. The 'Yankees' are distinguishable from the later 'Deltas' by having a smaller rise to the 'turtle-back' missile compartment abaft the sail. In 1976 one unit was converted to a **'Yankee II' class** configuration in which the original 16 missile tubes were replaced by 12 larger units for the experimental solid-propellant SS-NX-17 SLBM. The 'Yankee II' also differs from the similar 12-round 'Delta Is' by having a sloping forward edge to the 'turtle-back' casing of the missile tubes.

In order to comply with the SALT agreement a number of 'Yankee I' SSBNs have been deactivated as SLBM carriers. By mid-1984 10 had been so treated, a number being converted to SSNs by the complete removal of the missile section of the hull. Another has possibly become the trials platform for the highly accurate SS-N-21 533-mm (21-in) diameter 7-m (23-ft) long cruise missile with a single 200-kiloton yield warhead and a range of 3000 km (1,865 miles).

At present three or four of 14 'Yankee I' boats, plus the odd 'Yankee II' in the Northern Fleet, are on station at any one time off the eastern seaboard of the USA, with a further unit either on transit to or from a patrol area. Overlaps do occur, and these occasionally raise the number of boats on patrol. Of the nine 'Yankee Is' in the Pacific Fleet two are on permanent patrol off the USA's western seaboard with another on transit to or from the patrol zones. The forward-deployed 'Yankees' are assigned the wartime role of destroying time-sensitive area targets such as SAC bomber alert bases and carriers/SSBNs in port, and of disrupting the American higher command echelons as much as possible to ease the task of follow-up ICBM strikes. More recently, NATO sources have indicated that several of the 'Yankees' in each theatre have been switched to operate against theatre nuclear targets, with the submarines operating in sanctuary areas closer to the Soviet homeland. These vessels are believed to be replacing the older 'Hotel II' and 'Golf II' submarines in this role.

Specification

'Yankee' class

Displacement: 7,700 tons surfaced and 9,300 dived

Dimensions: length 130.0 m (426.5 ft); beam 11.6 m (38.1 ft); draught 8.0 m (26.3 ft)

Propulsion: two pressurized water-cooled reactors powering four steam turbines driving two shafts

Speed: 20 kts surfaced and 27 kts dived

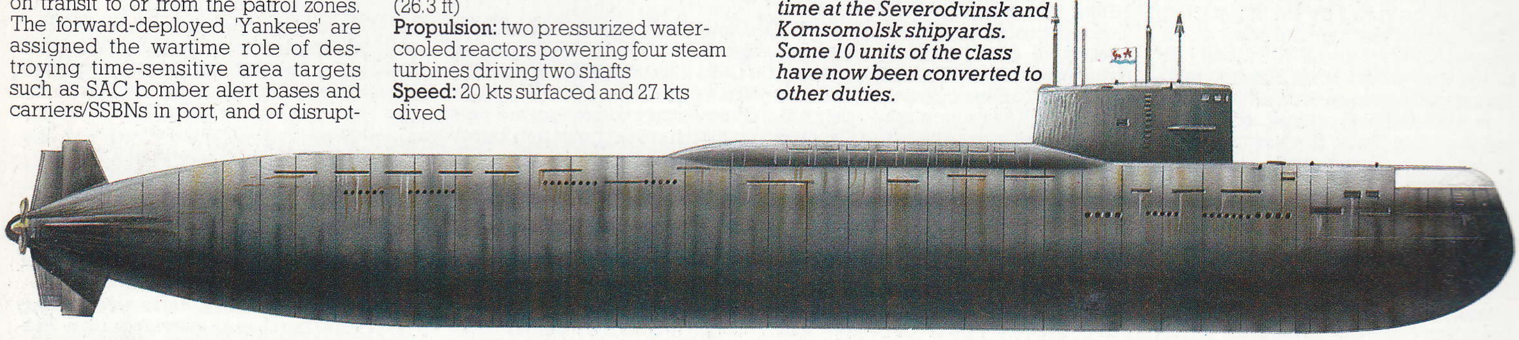
Diving depth: 400 m (1,315 ft) operational and 600 m (1,970 ft) maximum

Armament: 16 ('Yankee I') or 12 ('Yankee II') launch tubes for 16 SS-N-6 ('Yankee I') or 12 SS-NX-17 ('Yankee II') submarine-launched ballistic missiles, and six 533-mm (21-in) bow tubes for a maximum of 12 533-mm (21-in) weapons, though the normal load is eight 533-mm (21-in) ASW/anti-ship torpedoes and six 406-mm (16-in) ASW torpedoes

Electronics: one 'Snoop Tray' surface-search radar, one low-frequency bow sonar, one medium-frequency torpedo fire-control sonar, VHF/SHF/UHF communications systems, one VLF towed communications buoy, one ELF floating antenna, one 'Brick Group' ESM suite, and one 'Park Lamp' direction-finding antenna

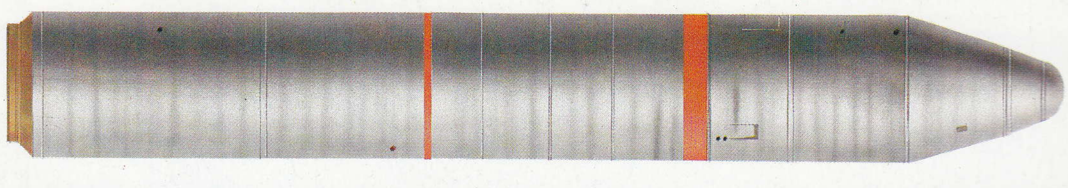
Complement: 130

A total of 34 'Yankee I' class submarines were constructed in a relatively short space of time at the Severodvinsk and Komsomolsk shipyards. Some 10 units of the class have now been converted to other duties.



USSR

SS-N-6 SLBM



Now being used in its Mod 3 version with two Multiple Re-entry Vehicle warheads, the SS-N-6 arms the 'Yankee I' class of SSBN.

The photographs that have been released of what NATO codenames **'Sawfly'** are in fact of a competitive prototype that was never taken into service. Such ruses are a common part of Soviet disinformation exercises. The actual **SS-N-6** was tested on a diesel-electric 'Golf' class submarine that was converted around 1970 to carry and fire six such weapons in a lengthened sail structure that was added to an 18-m (59-ft) extension to the hull. Being a third-generation weapon, the missile is actually something of a hybrid as it utilizes both components and technology derived from the land-based SS-11 ICBM. It is a single-stage SLBM with liquid-propellant propulsion. The original 2400-km (1,490-mile) range **SS-N-6 Mod 1** with a single 700-kiloton yield warhead entered service two years before the 'Golf' trials boat used to test the much improved and lighter **SS-N-6 Mod 2** variant in 1972. This missile uses a 650-kiloton warhead instead of the previous one and has a 600-km (375-mile) increase in range, which enables 'Yankees' cruising off either US seaboard to provide full target coverage from the 183-m (600-ft) contour. At the same time the **SS-N-6 Mod 3** began development, initial deployment happening in 1974, one year after the SS-N-6 Mod 2. This third variant has the same range as its predecessor, but the single RV has been replaced by two 350-kiloton yield multiple re-entry vehicles (MRVs) for use against large area targets such as cities. By 1985 those 'Yankee Is' that were left in service had either SS-N-6 Mod 1 or SS-N-6 Mod 3 missiles in their tubes.

Specification

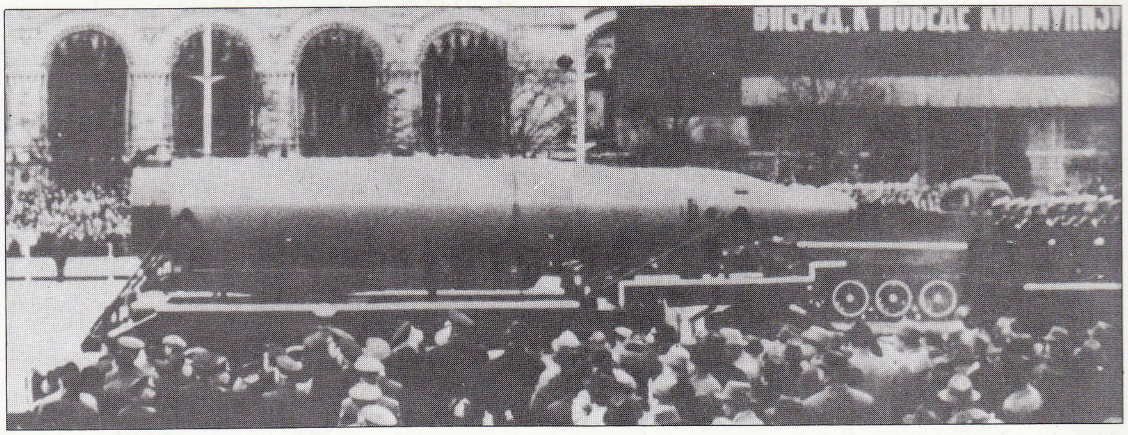
SS-N-6

Type: submarine-launched ballistic missile

Dimensions: length 10.0 m (32.8 ft); diameter 1.8 m (5 ft 10.9 in)

SS-N-6 SLBM (continued)

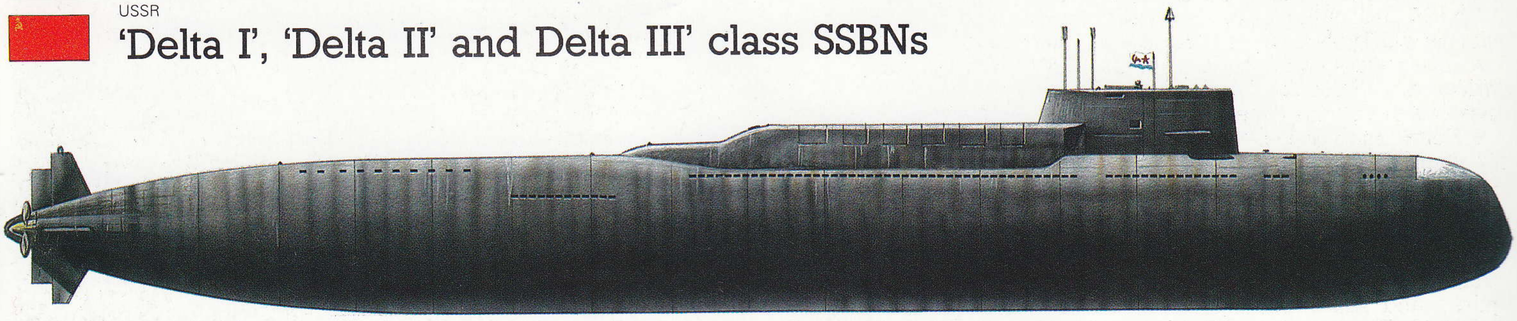
Launch weight: 18900 kg (41,667 lb)
Performance: range (Mod 1) 2400 km (1,490 miles) or (Mods 2 and 3) 3000 km (1,865 miles); CEP 1850 m (2,023 yards)
Warhead: one 700-kiloton yield re-entry vehicle in Mod 1, or one 650-kiloton yield re-entry vehicle in Mod 2, or two 350-kiloton yield MRVs in Mod 3
Propulsion: liquid-propellant rocket
Guidance: inertial



Predecessor to the SS-N-6 SLBM was the SS-N-5 'Serb'. This utilized a cold gas ejection system to fire the missile clear of the launch platform, where the main rocket motor was ignited. The 'Yankee' class SSBNs use a similar system to eject the SS-N-6 missiles from their launch tubes.

USSR

'Delta I', 'Delta II' and Delta III' class SSBNs



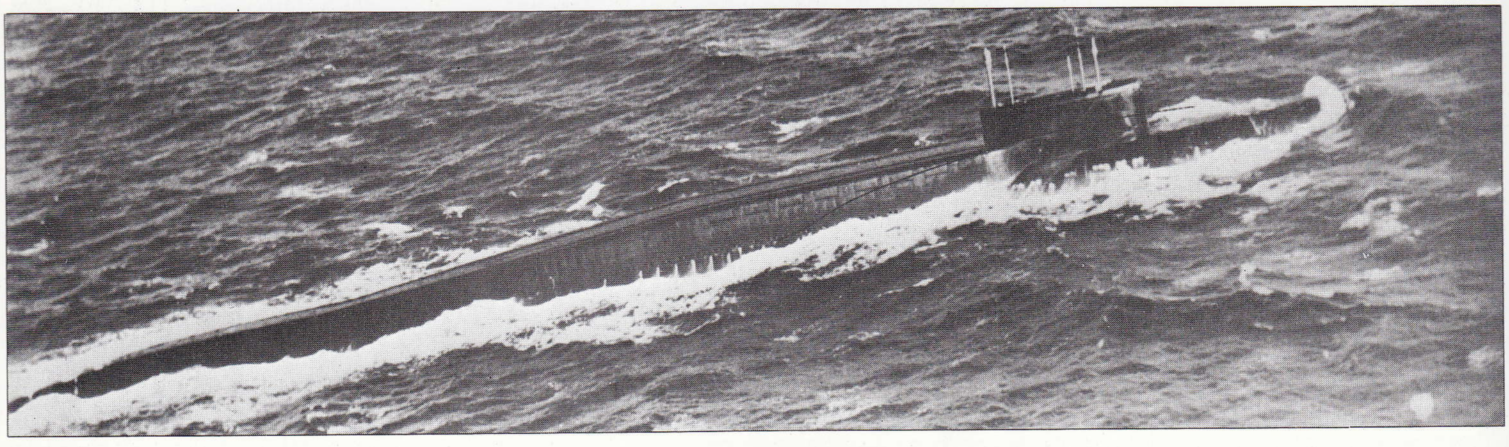
Now into its third variant, the 'Delta' class ballistic missile submarine is essentially the 'Yankee' design lengthened to accommodate new SLBMs.

The **'Delta I' class** design was an enlargement of the previous 'Yankee' class design. Built initially at Severodvinsk and then at Komsomolsk in the Soviet Far East, the 'Delta I' was the world's largest undersea craft when the first unit was completed in 1972. The eighteenth and last of the class was completed at Komsomolsk in 1977. Designated a ballistic missile submarine (*podvodnaya lodka raketnaya krylataya* or PLRK) by the Soviets, the class carries two parallel rows of six missile tubes for the SS-N-8 missile aft of the sail, which is set forward with diving planes on each side.

In 1975 at Severodvinsk an inteirm batch of four **'Delta II' class** units was constructed. These were essentially the earlier design lengthened by 16.2 m (53.2 ft) to make possible the incorporation of a further four missile tubes to match contemporary Western SSBNs. These boats were followed in 1976 by the first units of the **'Delta III' class**. They are similar to the 'Delta II' boats but have the 'turtle-back' structure aft of the sail increased in height to accommodate the longer and more capable SS-N-18 in the missile tubes. At present the 'Delta III' is in series construction, with some 15 units built to date, and at least another two or three are expected before a new variant is introduced to carry the SS-N-23. The 22 'Delta I', 'Delta II' and 'Delta III' class vessels in the Northern Fleet have patrol areas in the Greenland, Norwegian and Barents Seas with one vessel normally on patrol in each location. More recently it has been revealed that a further unit is deployed in the eastern Atlantic, probably as far south as the Azores, in order to complicate yet further the task of US defence radars. In the Pacific Fleet only two of 15 'Delta I' or 'Delta III' class units are on patrol at any one time, one in the Sea of Okhotsk and the other in the Bering Sea. However, in time of tension the number of units on patrol would be increased considerably so that an effective second strike force would be available in a protracted nuclear exchange. It was also revealed in the latest US Department of Defense *Soviet Military Power* document that the Soviets have been practising SLBM missile resupply from tenders in protected areas, whilst those submarines in port or under refit would for protection either be dispersed to concrete-hardened tunnels built into cliffs or be submerged in the deep fjords that lie just off their piers.

Specification

'Delta' class
Displacement: 8,750 tons surfaced and 10,000 tons dived for 'Delta I', and 9,750 tons surfaced and 11,000 tons dived for 'Delta II' and 'Delta III'
Dimensions: length 136.5 m (447.8 ft) for 'Delta I' and 152.7 m (501 ft) for 'Delta II' and 'Delta III'; beam 12.0 m (39.4 ft); draught 8.7 m (28.5 ft)
Propulsion: two pressurized water-cooled reactors powering four steam turbines driving two shafts
Speed: 20 kts surfaced and 26 kts ('Delta I'), 25 kts ('Delta II') or 24 kts ('Delta III') dived
Diving depth: 400 m (1,315 ft) operational and 600 m (1,970 ft) maximum
Armament: 12 ('Delta I') or 16 ('Delta II') launch tubes for 12 ('Delta I') or 16 ('Delta II') SS-N-8 submarine-launched ballistic missiles, or 16 launch tubes ('Delta III') for 16 SS-N-18 submarine-launched ballistic missiles, and six 533-mm (21-in) bow tubes for a maximum of 12 533-mm (21-in) weapons, though the normal load is eight 533-mm (21-in) ASW/anti-ship torpedoes and six 406-mm (16-in) ASW torpedoes
Electronics: one 'Snoop Tray' surface-search radar, one low-frequency bow sonar, one medium-frequency torpedo fire-control sonar, VHF/SHF/UHF communications systems, one VLF towed communications buoy, one ELF floating antenna, one 'Brick Group' ESM suite, one 'Park Lamp' direction-finding antenna, and one 'Pert Spring' satellite navigation system
Complement: 130 ('Delta I') or 140 ('Delta II' and 'Delta III')



Only four 'Delta II' class submarines were built, as an interim design. The only difference between the vessels and the earlier 'Delta Is' is an increase in hull length.

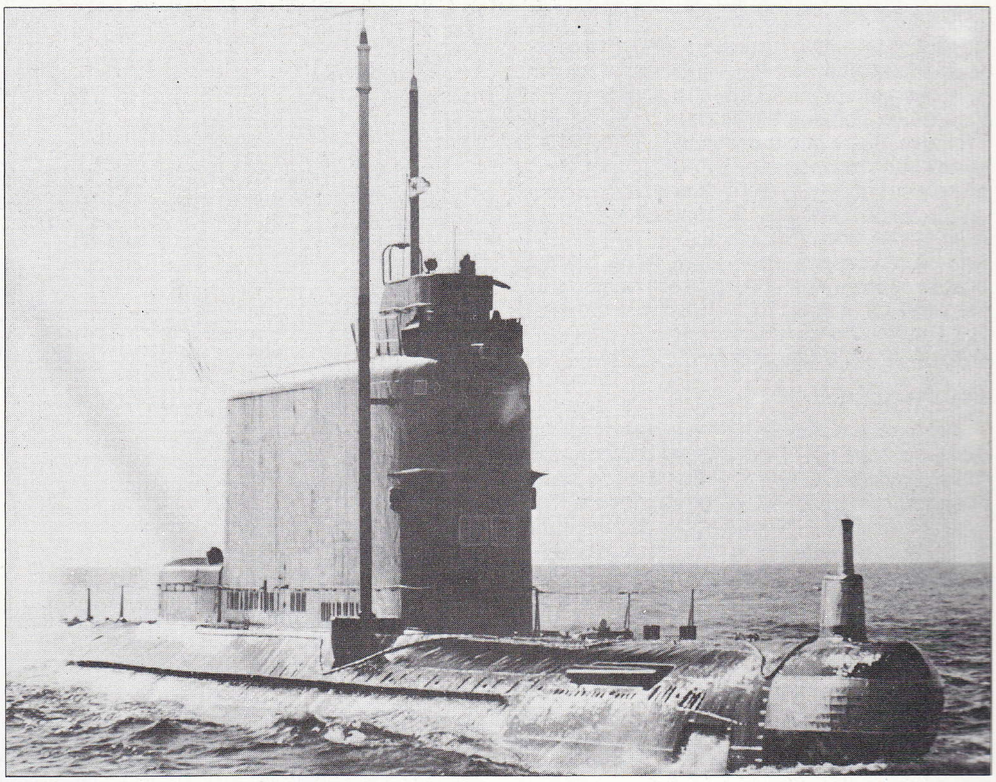
Soviet Submarines in Action

With a tradition of submarine operations, the Soviet navy has long maintained the largest submarine force in the world, the surest shield against nuclear attack being a submarine-based deterrent.

The Soviet Union maintains the world's largest force of ballistic missile submarines for strategic attack. As of March 1984 the force numbered 64 vessels embarking a total of 936 nuclear-tipped missiles. Two of the total do not count towards the SALT limit of 62 SSBNs, whilst an additional 15 older vessels with 45 embarked missiles are not included in SALT limitations because they are assigned to the theatre strike and anti-shipping roles.

The 14 units of the 'Delta III' class, together with the two 'Typhoons', were completed in the last seven years and carry the Soviets' SLBM MIRV force of 264 SS-N-18 and SS-N-20 missiles. It is these units, together with the 18 earlier 'Delta I' and four 'Delta II' class boats, which are fitted with the long-range SS-N-8 that permits the boats' assignment to patrol areas in waters adjacent to the Soviet Union. This affords the boats considerable immunity from NATO ASW operations, and also allows the submarines to fire from their home ports if required and still strike the continental USA (CONUS). The remaining 22 'Yankee I' class boats and the solitary 'Yankee II' unit are used primarily on forward-deployment patrols off both coasts of the CONUS to disrupt American strategic command, control and communications networks in the early minutes of a nuclear exchange and to destroy as many strategic weapon systems (such as SAC bombers on alert and SSBNs still in port) as possible. More recently it has learnt that several 'Yankees' have been reassigned to patrol areas on the eastern side of the Atlantic and the Norwegian sea, where as part of the Soviet theatre nuclear forces they can bombard places such as the UK. To ensure an adequate level of communications under most operating conditions, the Soviets are deploying an extremely low frequency (ELF) radio transmission system that will allow the submarines to receive messages at depths well in excess of what is achieved currently by using towed buoys and floating antennae.

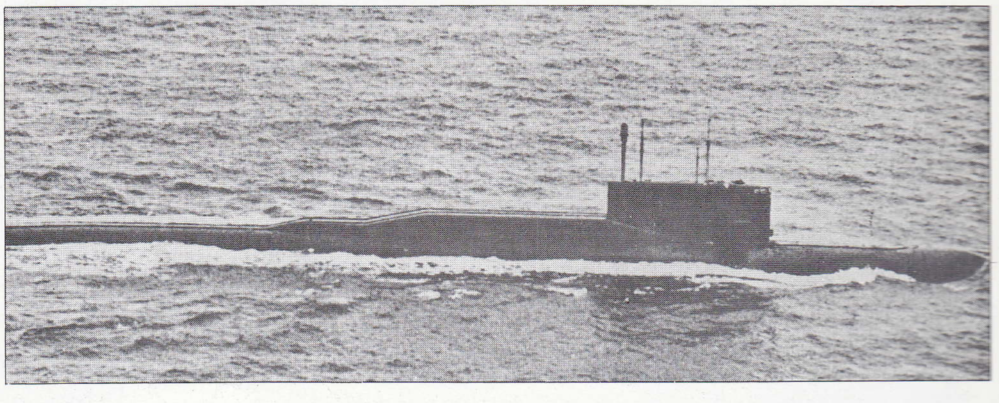
To enhance their SSBNs' capabilities further in a protracted nuclear exchange, the Soviets are regularly practising the resupply of missile-exhausted SSBNs from missile tenders anchored in protected waters, the reloading and refurbishment of the missile tubes taking less than 24 hours to complete. In these resupply zones, and in the sanctuary areas within which the SSBNs operate close to the Soviet homeland, specialist surface warship and submarine task groups with regimental-sized maritime patrol aircraft support are assigned to deal with any NATO ASW units that may attempt to attack the missile submarines. But if the Americans go after the command echelons ashore, and destroy the hardened underground bunkers which house them, then alternative mobile aircraft and multiple vehicle-based command posts are available. The SSBNs which are still under refit or simply have not sailed would be dispersed to protected camouflaged tunnels constructed near their home ports or taken out to the deep water fjords just off the docks and submerged.



One of the remaining 'Golf-II' conventional powered ballistic missile submarines is fitted with three tubes for the SS-N-5 'Serb', retained in the Northern Fleet for trials purposes.

At present the Soviet navy's Northern Fleet has the majority of the SSBN force with two 'Typhoons', 21 'Delta I/II/III', 14 'Yankee I' and the single 'Yankee II', together with several older 'Hotel II' and 'Golf' trials vessels. All are located at bases on the Kola peninsula. The Pacific Fleet, with nine 'Yankee I' and 15 'Delta I/III' class boats, has two SSBN bases, one near Petropavlovsk on the Kamchatka peninsula and the other near Vladivostok close to the junction of the Soviet, Chinese and North Korean borders. It is likely that the 'Deltas' and strategic-role 'Yankees' operate from the former as it gives access to both the Sea of Okhotsk and Bering Sea sanctuary area, whilst the latter base would house the theatre-role 'Yankees' as it is close to Japan and well within launch range of most of the important American Far Eastern bases.

The Northern Fleet missile boats have a much harder task if they want to transit to patrol areas off the US eastern seaboard or for the occasional 'Delta' that goes as far south as the Azores, since the vessels have to transit the natural series of 'choke points' known as the Greenland-Iceland-United Kingdom Gap. This offers NATO the best chance of detecting them by use of the Sound Surveillance Under Sea (SOSUS) fixed sonar array network. The remaining 'Deltas' and 'Typhoons' that operate on the Soviet side of the gap have to be hunted down by individual nuclear-powered NATO attack submarines sent into their sanctuaries on high-risk missions with little chance of survival once they have destroyed a target. To increase NATO's problems further, the 'Typhoon' force would actually be operating within the Arctic icepack which is a notoriously difficult ASW

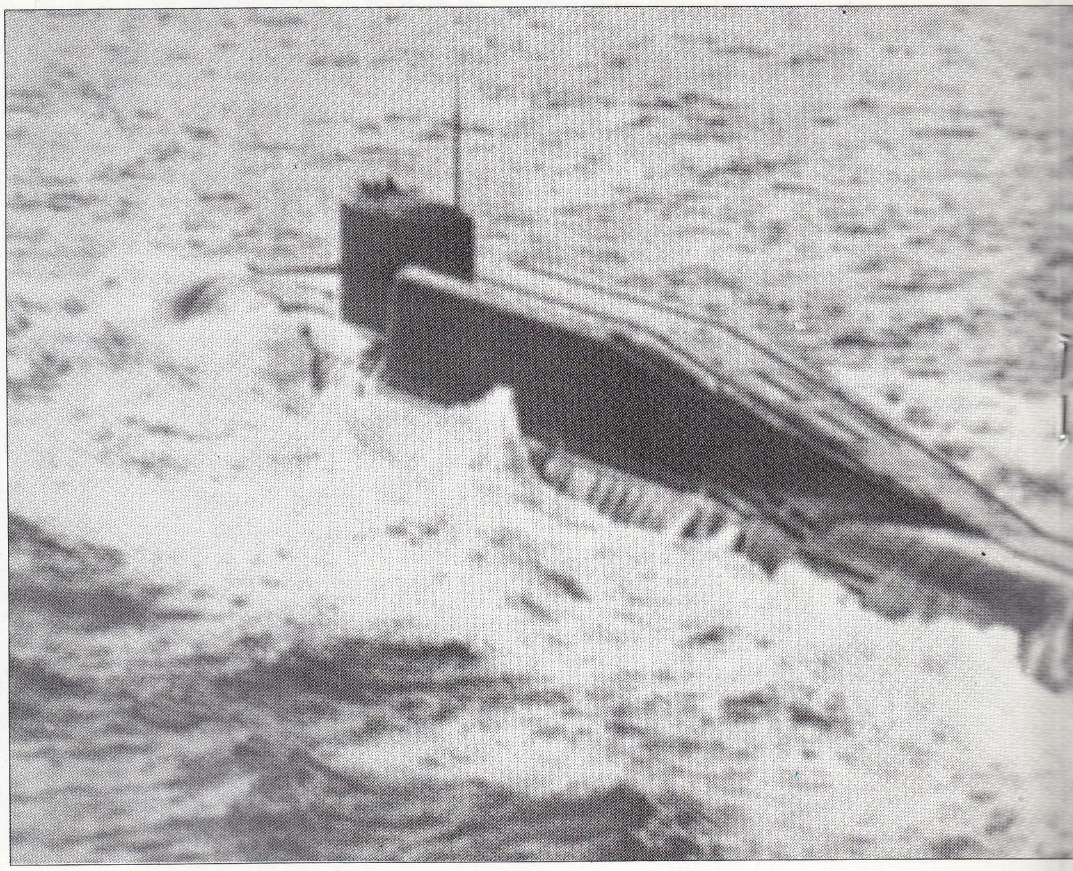


The sole 'Yankee II' SSBN is converted to carry 12 SS-N-17 instead of 16 SS-N-6 missiles. In all other respects the boat is similar to the 'Yankee I', being some two or three knots faster underwater than any of the contemporary western SSBN designs. It is based on the Kola Peninsula.

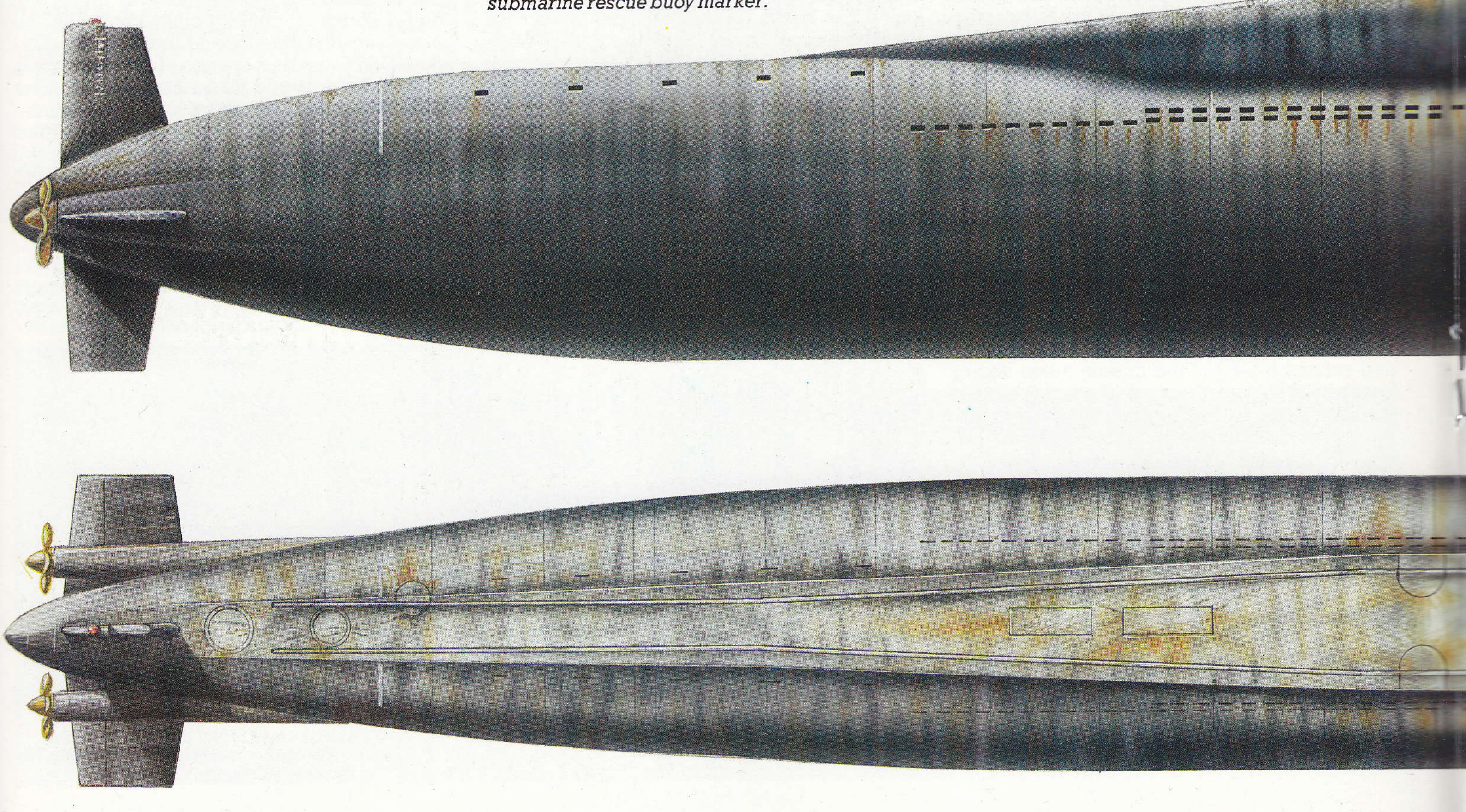
environment because of the high background noise from the moving ice flows. Submarines which hide within or just under the ice (as the 'Typhoon' is built to do) could only be detected at relatively short ranges by other submarines operating at very slow speeds, a tactical situation which nullifies the normal advantages of Western attack submarines so that the winner of any such engagement would simply be the more alert unit with the quicker trigger finger on the torpedoes. This is the main reason why both the UK and USA are placing great emphasis on under-ice ASW operations by their attack submarines, periodically announcing the sending of such craft on 'trips' to the North Pole and staging submarine exercises by several boats within the Arctic circle.

Future plans

For the future the Soviets are certain to capitalize on this NATO deficiency by increasing their 'Typhoon' fleet for under-the-ice operations and by decreasing the number of their forward-deployed 'Yankees' to the minimum required, so enhancing the survivability of their SSBN forces. A new MIRVed SLBM is already under flight test for future retrofitting to the existing 'Delta IIIs' and to arm a new mid-1980s SSBN class to complement the 'Typhoons'. Older vessels such as the 'Delta Is' may well be switched to theatre roles, while the 'Yankees' appear to be under gradual conversion to other tasks including, possibly, one of the main carriers of the Soviet submarine-launched cruise missile force of SS-N-21s.

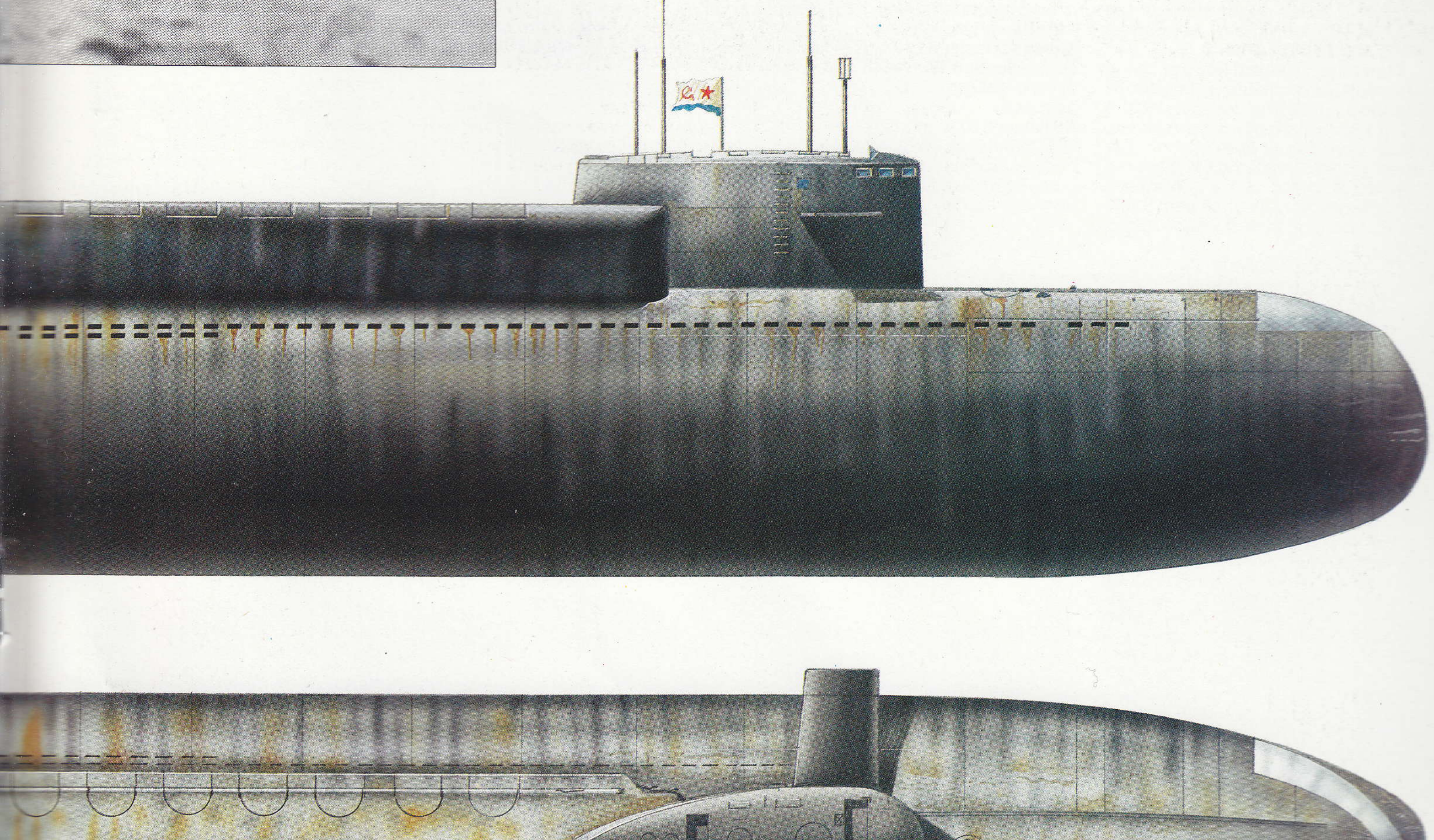


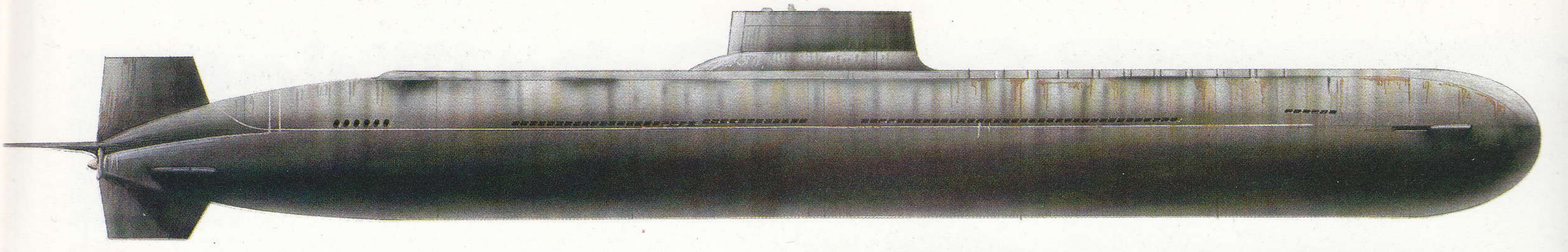
Above: Construction of the 'Delta III' class continues at Severodvinsk at the rate of two units per year. The hatches in the aft part of the raised rear decking are believed to cover towed very low frequency communications buoys, whilst just forward of the rudder can be seen the top of a submarine rescue buoy marker.



Soviet 'Delta III' class Ballistic Missile Submarine

Below: For many years the world's largest underwater vessel, the 'Delta III' class of ballistic missile submarine is a mainstay of current Soviet strategic capability. At least 15 have been built at Severodvinsk, with several more under construction, possibly in a modified form to take the next-generation SS-N-23 missile. At present the class is armed with 16 SS-N-18 MIRV missiles, each with several low-yield warheads. The SS-N-18 has a range of up to 8000 km (almost 5,000 miles).





A true monster of the deep, the Typhoon *has been designed for operations under the polar ice. Its huge size enables it to be armed with missiles capable of hitting the continental* USA *without ever having to leave northern Soviet waters.*

USSR

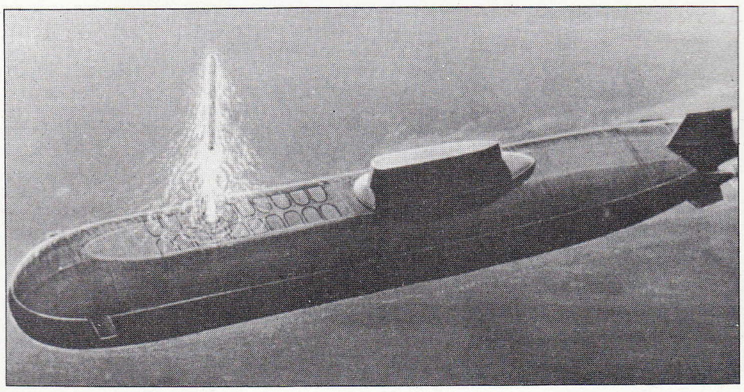
'Typhoon' SSBN and 'SS-N-20' SLBM

The **'Typhoon' class** boats are the largest undersea vessels yet built, and are believed to be based on a catamaran-type design that comprises two 'Delta III' hulls joined by a single outer covering to give increased protection against ASW weapons. In overall size a 'Typhoon' is almost half as long again as the US 'Ohio' class Trident missile-carrying submarines, and has a displacement some 9,500 tons greater when running on the surface. It is thought that the class has been built specifically for operations with the Soviet Northern Fleet in the Arctic ice-pack. The two parallel rows of missile tubes fitted forward of the stub-like sail aft of the craft's centre point, together with the high-rise hull and retractable bow hydroplanes, allows the submarine to break easily through the spots of thin ice (known as polnyas) within the Arctic ice shelf.

The first unit was laid down in 1975 at Severodvinsk and launched in 1980. It achieved operational status in 1983. A second unit has now been completed, whilst there are at least another four under series construction in a special covered shipyard. A US intelligence report suggests that by the early 1990s eight of these monsters will be in service.

To arm the 'Typhoon' the Soviets started to design a fifth-generation SLBM, the **SS-N-20**, from 1973. First-flight tested in 1980, the SS-N-20 is a three-stage solid-propellant MIRVed missile with a range of 8300 km (5,160 miles). This allows the submarine to fire the weapon from within the Arctic circle and still hit a target anywhere within the continental USA. Before the end of this decade the Soviets are due to test fly an improved version of the SS-N-20.

Specification
'Typhoon' class
Displacement: 26,000 tons surfaced and 30,000 tons dived
Dimensions: length 170.0 m (557.7 ft); beam 23.0 m (75.5 ft); draught not known
Propulsion: four pressurized water-cooled reactors powering four steam turbines driving four shafts
Speed: 20 kts surfaced and 30 kts dived
Diving depth: 400 m (1,315 ft) operational and 600 m (1,970 ft) maximum
Armament: 20 launch tubes for 20 SS-N-20 submarine-launched ballistic missiles, and six 533-mm (21-in) bow tubes for a maximum of 24 533-mm (21-in) weapons, though the normal load is 16 533-mm (21-in) ASW/anti-ship torpedoes and 14 407-mm (16-in) ASW torpedoes
Electronics: one surface-search radar, one ESM system, one low-frequency bow sonar, one medium-frequency torpedo fire-control sonar, VHF/SHF/UHF communications systems, one VLF towed communications buoy, and one ELF floating antenna
Complement: 150



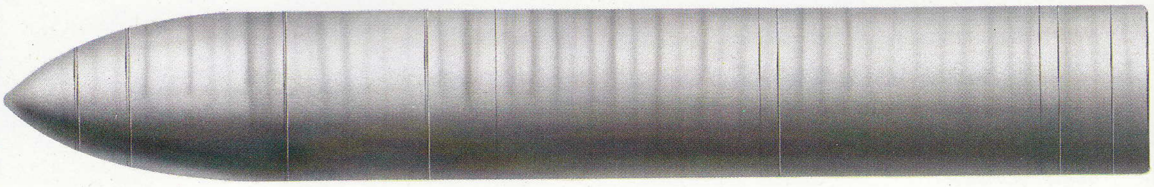
The mammoth Typhoon *SSBN is thought to be comprised of two 'Delta' class hulls in a side-by-side configuration with the missile tube compartment forward of the sail.*

Such submarines are being built for operations beneath and within the polar ice regions of the northern hemisphere.

Specification
SS-N-20
Type: submarine-launched ballistic missile
Dimensions: length 15.0 m (49.2 ft); diameter 2.0 m (6 ft 6.7 in)
Launch weight: not known
Performance: range 8300 km (5,160 miles); CEP better than 1400 m (1,530 yards)
Warhead: between six and nine MIRVs of unknown yield
Propulsion: solid-propellant rocket
Guidance: stellar-inertial

USSR

SS-N-8, SS-N-18 and SS-NX-23 SLBMs



Introduced into operational service in 1972 aboard the 'Delta I' class SSBN, the **SS-N-8** is a fourth-generation SLBM that began flight trials back in 1969 aboard a lengthened 'Hotel' class nuclear-powered ballistic missile submarine (codenamed 'Hotel III') converted to carry and fire three of the missiles in an enlarged sail. A second trials vessel was converted in the early 1970s from a diesel-electric 'Golf' class ballistic missile submarine. Codenamed 'Golf III' and fitted to carry and fire six SS-N-8s, the vessel has now been dismantled under the SALT limitations. The SS-N-8 is a two-stage liquid-propellant missile that, in its **SS-N-8 Mod 1** form, has a range of 7800 km (4,845 miles). To ensure accuracy over that range, stellar-inertial guidance is used to update the navigation computer by utilizing two 'star fixes' for mid-course flight profile corrections. In 1977 an engineering improved variant, the **SS-N-8 Mod 2**, entered service with a range of 9100 km (5,655 miles) and the same warhead.

However, two years before this the Soviets had begun flight testing of the fourth-generation 6500-km (4,040-mile) range storable liquid-propellant **SS-N-18** (Soviet designation **RSM-50**) which became operational on the 'Delta III' class in late 1976. The **SS-N-18 Mod 1** version was also the first Soviet SLBM to feature MIRV capability. This was followed in 1979 by the **SS-N-Mod 2** with a single warhead but much greater range. The SS-N-18 Mod 1 was then superseded in the same year by the **SS-N-18 Mod 3** which has a larger number of lower-yield MIRVs and the same range.

Both the SS-N-8 and the SS-N-18 are expected to be replaced by a new liquid-propellant SLBM, the **SS-NX-23**, which is of similar size to the latter missile but will have a greater throw-weight, carry more MIRVs and be considerably more accurate. It is expected to equip a 'Delta III' variant initially and then be retrofitted to the earlier boats.

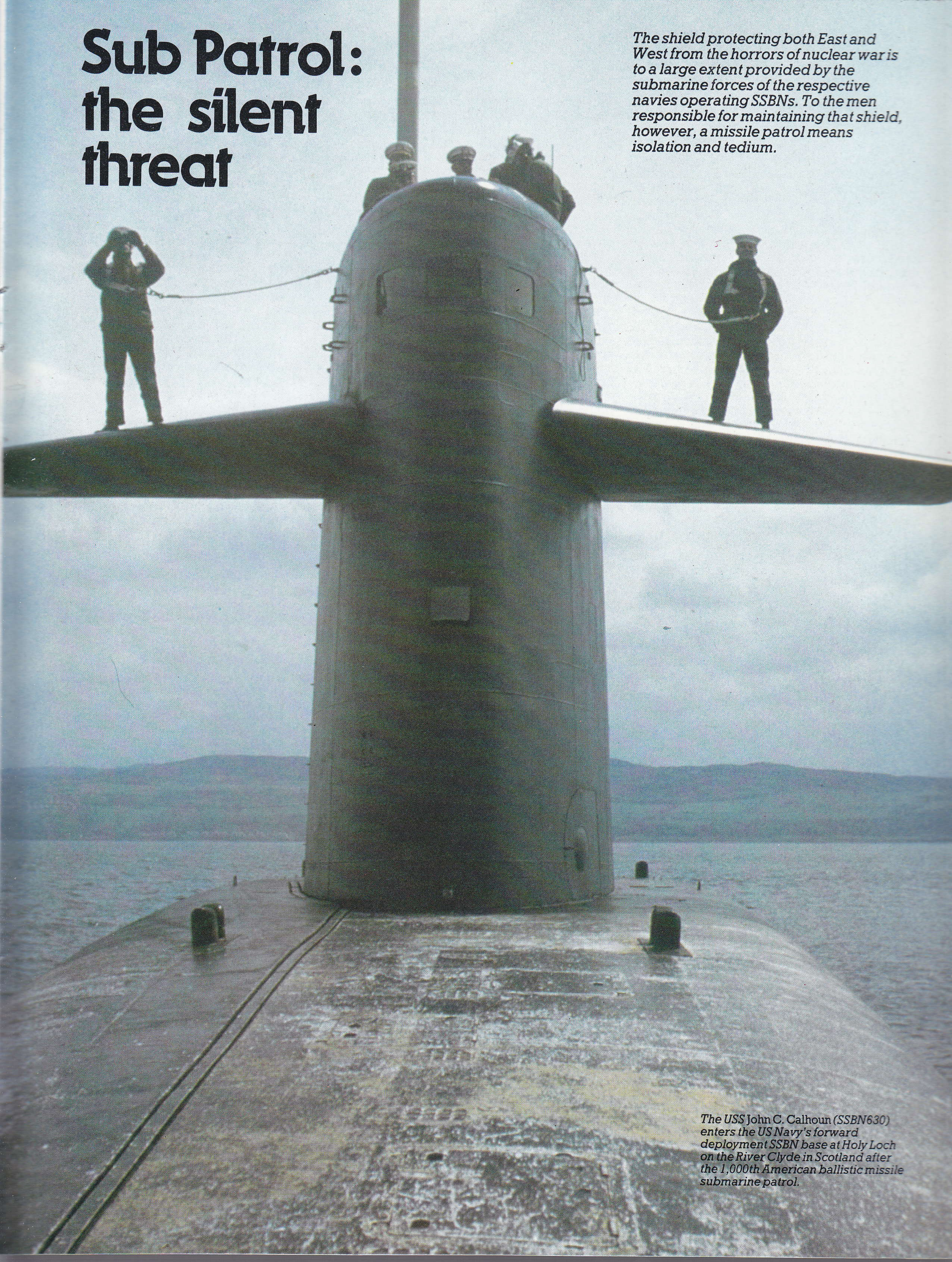
Specification
SS-N-8
Type: submarine-launched ballistic missile
Dimensions: length 12.9 m (42.3 ft); diameter 1.65 m (5 ft 5 in)
Launch weight: 20400 kg (44,974 lb)
Performance: range (Mod 1) 7800 km (4,845 miles) or (Mod 2) 9100 km (5,655 miles); CEP (Mod 1) 1410 m (1,540 yards) or (Mod 2) 1550 m (1,695 yards)
Warhead: one 800-kiloton re-entry vehicle
Propulsion: liquid-propellant rocket
Guidance: stellar-inertial

The SS-N-18 is now the mainstay of the Soviet SSBN force with the introduction into service of a version carrying Multiple Independent Re-entry Vehicle warheads.

Specification
SS-N-18
Type: submarine-launched ballistic missile
Dimensions: length 14.1 m (46.3 ft); diameter 1.8 m (5 ft 10.9 in)
Launch weight: 25000 kg (55,115 lb)
Performance: range (Mods 1 and 3) 6500 km (4,040 miles) or (Mod 2) 8000 km (4,970 miles); CEP (Mods 1 and 3) 1410 m (1,540 yards) or (Mod 2) 1550 m (1,695 yards)
Propulsion: liquid-propellant rocket
Guidance: stellar-inertial

Sub Patrol: the silent threat

The shield protecting both East and West from the horrors of nuclear war is to a large extent provided by the submarine forces of the respective navies operating SSBNs. To the men responsible for maintaining that shield, however, a missile patrol means isolation and tedium.



The USS John C. Calhoun *(SSBN630) enters the US Navy's forward deployment SSBN base at Holy Loch on the River Clyde in Scotland after the 1,000th American ballistic missile submarine patrol.*

As the last lines are slipped, the small tug pushes the great bulk of the SSBN towards the centre of the Clyde river and the run to the open water beyond, where the SSBN will slip beneath the waves for a lonely two-month patrol. Ahead lies the usual cat-and-mouse game with the Soviet intelligence-gathering trawler off Northern Ireland, whose job it is to record the boat's acoustic signature and to signal the boat's course back to the Soviet navy headquarters near Moscow. The Soviets already know she is due to come down the river by studying the patrol cycles, but do not know the actual date or time of departure, which are obtained by the resident GRU (Soviet military intelligence) officers, who live along the banks of the Clyde with the sole task of monitoring the movements to and from the British SSBN base at Faslane and the American submarine tender at Holy Loch.

With nuclear power for propulsion and continual regeneration of the atmosphere, the endurance of the vessel is limited only by food storage capacity and the stamina of the crew. To take full advantage of this, the Royal Navy uses two alternating crews, each with its own skipper and full complement of officers and enlisted men. One crew takes the boat on patrol whilst the other remains in the home port undergoing refresher courses, taking leave or inducting new crewmen into the routine of operations.

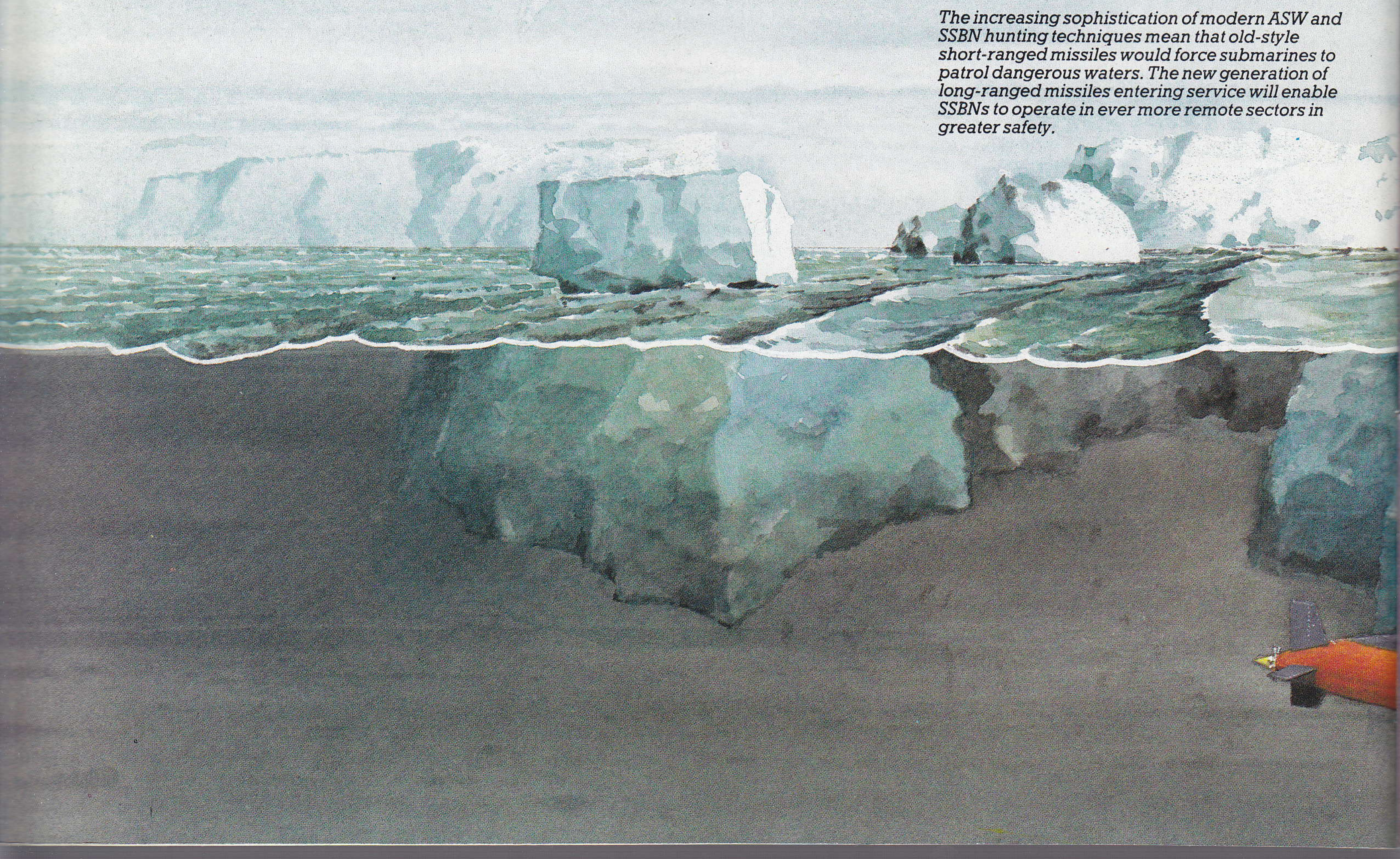
The skipper of the crew on patrol takes the SSBN on the surface down the river and once clear of the mouth dives it to begin a complex series of escape and evasion manoeuvres designed to outwit and confuse the watching Soviets in the trawler as to the direction taken. If by chance the Soviets have a submarine waiting to attempt to trail the SSBN, then the SSBN will halt for the appropriate 'delousing' operation by friendly units. Once free of unwelcome eyes the boat commences the trip to the patrol area fully submerged.

Where it actually goes, the route taken and the final return date is only known to the skipper. No messages are transmitted during the duration of the patrol, but the boat approaches to within several hundred feet of the surface at regular intervals to receive operational messages and short family messages at periodic intervals via the floating ELF antenna and VLF towed communications buoy that it carries. As the boat heads towards the designated patrol area at transit speed, the crew settles into the routine that will be followed for the entire cruise. Within the patrol zone the speed is reduced to only a few knots to reduce the chances of detection, but the boat will be kept within firing range of its targets in the Soviet Union at all times. The main emphasis of the daily schedules is directed towards keeping the 16 weapons in the missile tubes in the ready-to-launch status. All 16 will be available for around 95 per cent of the time spent in the patrol area, whilst 15 will be ready for over 99 per cent of the time. The crew are kept at a constant state of alert by periodical missile-firing drills, but an actual launch can only be conducted when the appropriate codes have been received for the firing panel and safety locks have been simultaneously disarmed by the skipper and one of his officers.

Evasive action

Apart from being ready to fire at any time, the boat has also to be ready to take evasive action if any strange surface or submarine craft are detected in the vicinity. To do this the boat carries the latest state-of-the-art passive sonar systems including a long-range retractable towed array which is streamed astern at every opportunity to allow monitoring of contacts out to a radius of 160 km (100 miles) or so around the boat's position. If the SSBN is detected, which both the Royal Navy and the US Navy have claimed has never been done by the Soviets, self-defence acoustic-homing torpedoes and powered decoys are carried in the forward torpedo room ready for use against any hostile intent. But these are to be used only in the final resort as the SSBN's primary defence is the boat's stealth aspects. It is because of this secrecy about location that the submarine sends no radio communications since the Soviets have a very capable radio direction-finding network based on shore stations and ferret satellites to watch out for just such transmissions.

Unlike its Soviet contemporary, the monstrous 'Typhoon' class, the 'Ohio' class of SSBN is not equipped to operate through weak spots (known as polnyas) in the polar ice. In areas where the ice forms bergs, however, modern sonar equipment would enable a submarine to shelter in the 'shadow' of the ice.



The increasing sophistication of modern ASW and SSBN hunting techniques mean that old-style short-ranged missiles would force submarines to patrol dangerous waters. The new generation of long-ranged missiles entering service will enable SSBNs to operate in ever more remote sectors in greater safety.

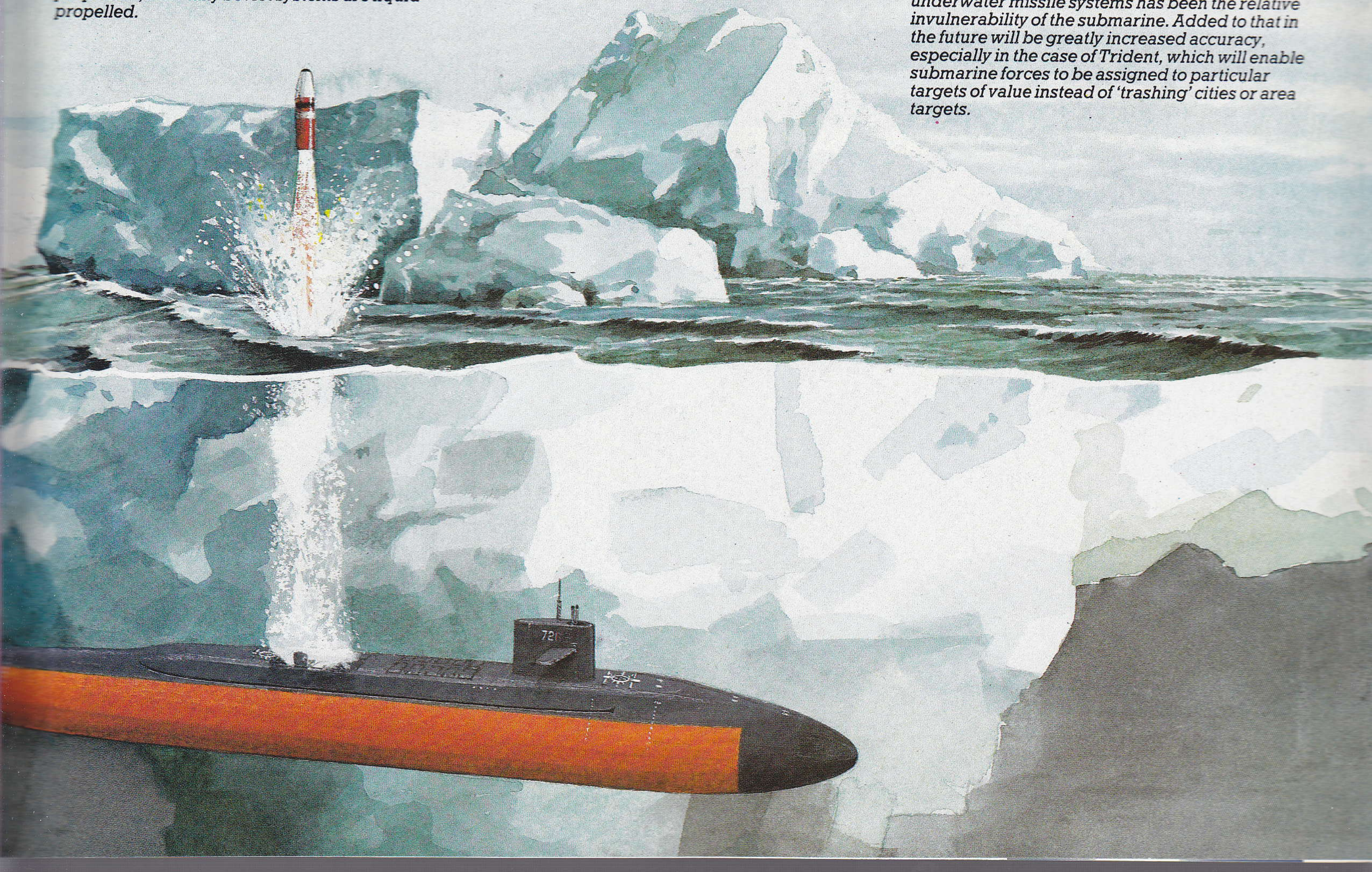
Crew accommodation

Internally the ballistic missile submarines are a lot bigger and roomier than other nuclear-powered submarines. The captain and the first or executive officer usually have their own cabins whilst the remaining officers share two- or three-berth rooms. The petty officers and enlisted men all have individual bunks, and the main mess is larger than normal as it also doubles up as the recreation hall, movie theatre and study area. Internal decoration is chosen to provide a pleasant working environment to help offset the boredom that may be encountered on long patrols. The ship's cooks are given more than enough food to cover the duration of the patrol and they make sure that the meals served throughout the daily cycle are to a very high culinary standard; they have the additional problem that the sailors eat in shifts as a result of watchkeeping requirements, so most types of meals have to be available at all times. To reduce the possibility of boredom talent shows, games and concerts are also arranged.

Once the time arrives for the submarine to return to base it picks up speed again for the transit, and as it starts the withdrawal the boat avoids any possible sonar contacts by using the same tactics as those employed against the Soviet trawler. The SSBN again adopts these as the Clyde estuary is approached, and surfaces near to the mouth only to make the run up the river to the docks. The crew then spends a couple of days or so handing over the boat to the other crew for the next patrol cycle. A few days before departure the boat is taken to sea for a short shakedown trip to see if the vessel and the equipment aboard are seaworthy.

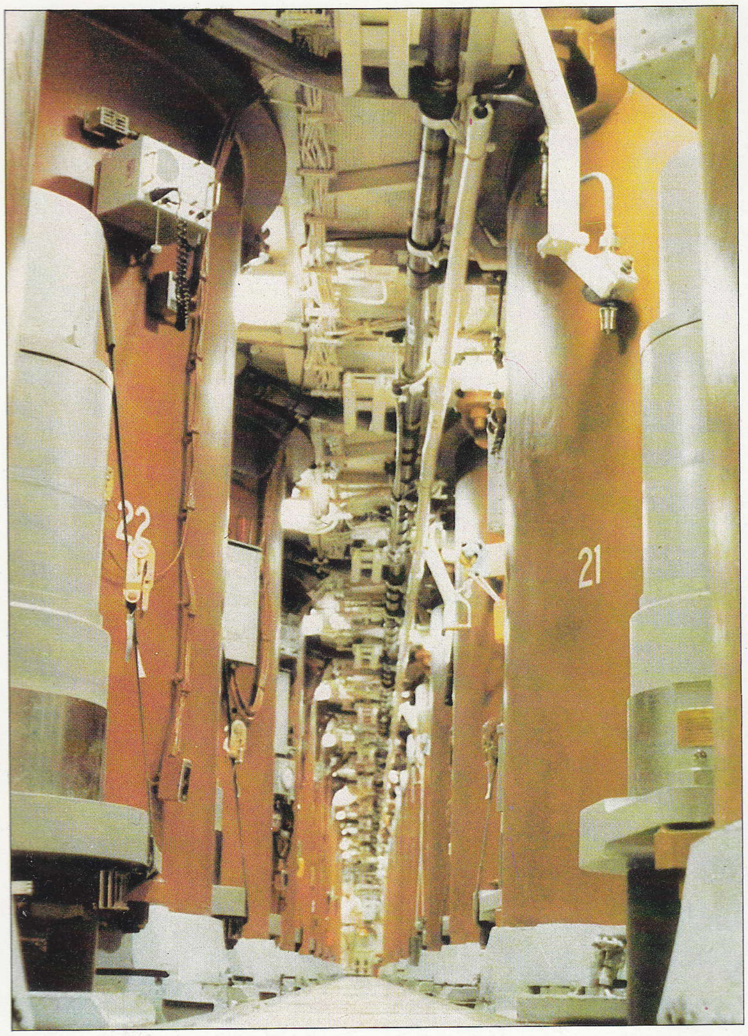
Vulnerability

The SSBN is at its most vulnerable when sailing to or returning from a patrol, usually on the final leg whilst on the surface within several miles of its base. In times of tension or war it will be necessary to increase protection afforded to the vessels at these points, especially against mines and air attacks. Those SSBNs operating from the Clyde are particularly open to attack from the former as the Soviets would probably try numbers of its special ASW rising mines and underwater electrical potential influence mines on the continental shelf and continental rise just off the western isles of Scotland, astride submarine transit routes that have been determined by watching SSBN operations in peacetime. The attrition of missile submarines at such points could then easily be passed off as unintentional by-products of the conventional war phase rather than a direct assault on the West's strategic strike forces with all that entails. Although the invulnerability of the SSBN on patrol is quite often quoted by Western naval chiefs as one of the major advantages of such forces, the years of painstaking collection and collation by the Soviets of all intelligence information, hydrographic data and probable targeting patterns of Western SLBMs could easily suggest the likeliest oceanic areas for the location of patrol zones. In wartime these would therefore receive the appropriate Soviet attention up to and including the launch of ICBMs. Nor does the Western view take into consideration the introduction of new Soviet ASW systems exemplified by the recent testing of synthetic-aperture radars which can apparently detect submerged submarines down to several hundreds of feet below the surface. This means that satellite-based systems and aircraft fitted with the radar would have the ability to detect SSBNs as they hover near the surface to receive communications. If the technique actually works then the introduction of the 'Ohio' class SSBN into patrol areas even more remote from the Soviet homeland than before becomes of paramount importance, as does the introduction of the UK's new deterrent force with the Trident II SLBM if the current status quo is to be maintained.



Most modern missiles are 'cold launched', ejected from their missile tube by compressed gases, the rocket motor igniting as the weapon reaches the surface. All Western missiles have a solid propellant, but many Soviet systems are liquid-propelled.

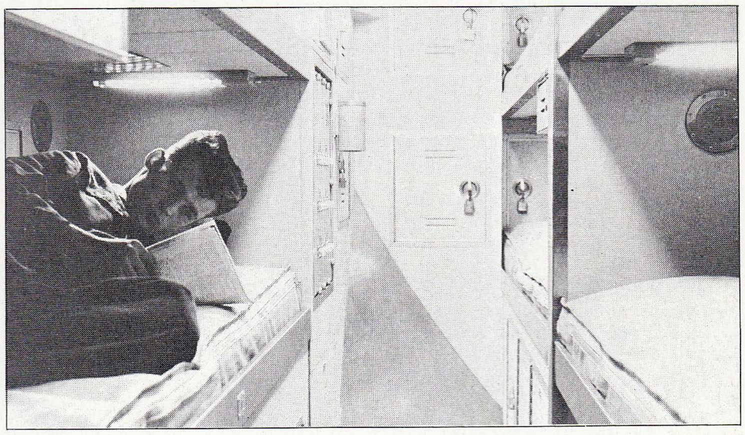
In the past, the major deterrent effect of underwater missile systems has been the relative invulnerability of the submarine. Added to that in the future will be greatly increased accuracy, especially in the case of Trident, which will enable submarine forces to be assigned to particular targets of value instead of 'trashing' cities or area targets.



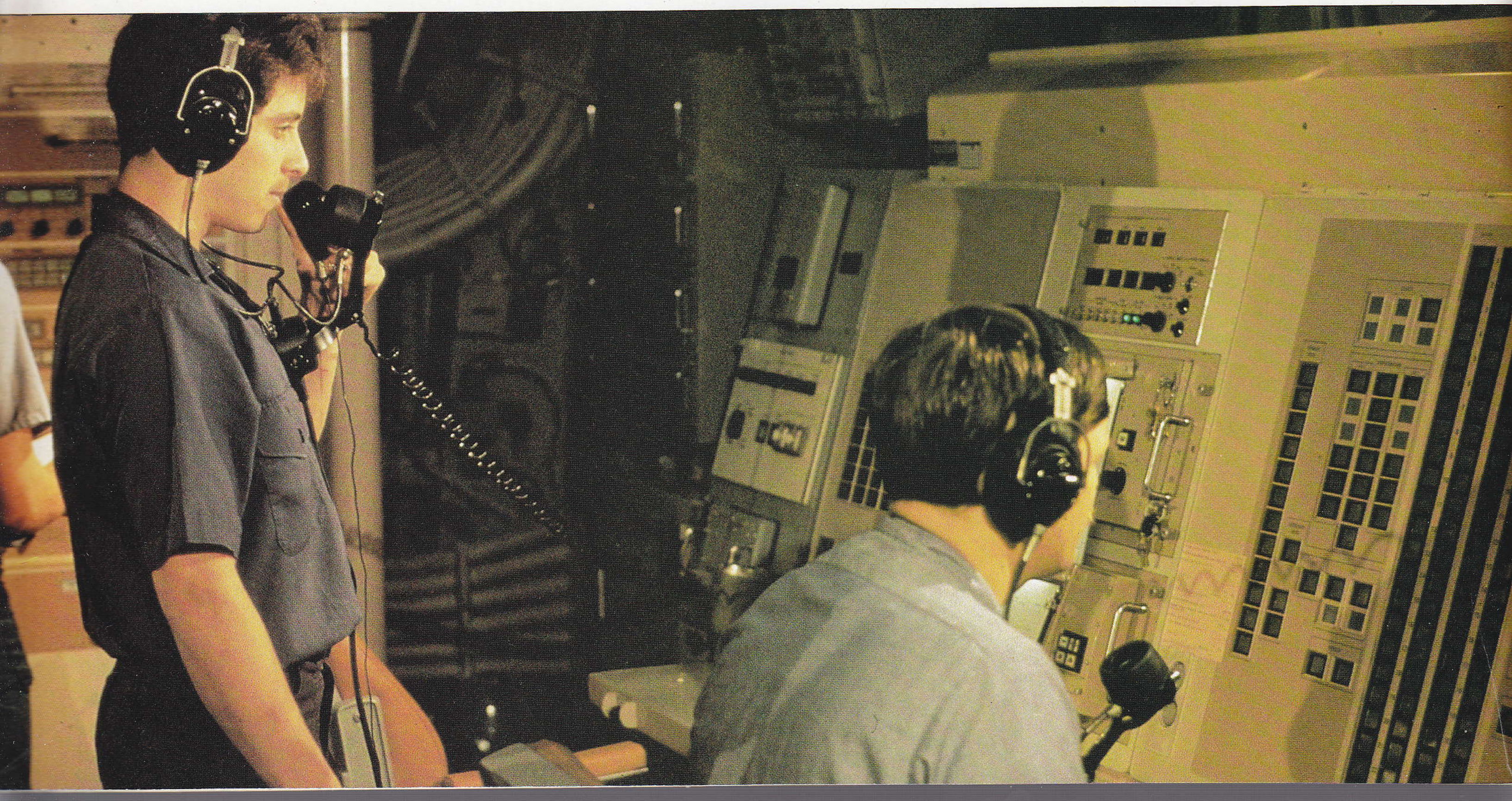
Above: The immense size of the 'Ohio' class can be gauged from this internal view of the C4 Trident I missile tube compartment. Any maintenance on the missiles whilst in their tubes is performed here, as are the continual checks to see if they are still functional.

Above: Missile submarines rely on secrecy for their own protection, the latest sonars being used to evade any hostile tactical confrontation.

Below: Although much better off than crewmen aboard conventional submarines, those on long submerged SSBN patrols can still find life tedious.



Below: The primary offensive station aboard any SSBN is the missile fire control panel. Should the unthinkable occur, the men in these positions would have the awesome responsibility of exercising the final option, and potentially causing destruction on an unparalleled scale.



USA

'Benjamin Franklin' and 'Lafayette' class SSBNs

Although actually two classes, the 12 **'Benjamin Franklin' class** and 19 **'Lafayette' class** submarines are very similar in appearance. The main difference is that the former were built with quieter machinery outfits. All have diesel-electric stand-by propulsion, snort masts and an auxiliary propeller. As built, the first eight 'Lafayettes' carried 16 single 800-kiloton yield warhead 2775-km (1,725-mile) range Polaris A2 SLBMs, the rest receiving the Polaris A3 fitted with three 200-kiloton yield MRVs. Of the Polaris A2 boats four (SSBN620 and SSBN622-625) were rearmed with the Polaris A3 during refuelling overhauls in 1968-70. In August of the latter year SSBN627 became the first of the Poseidon C3 SLBM conversions, whilst between September 1978 and December 1982 12 units were further converted to carry and fire the Trident I C4 SLBM. All 31 units serve with the Atlantic Fleet, several being forward-deployed to a submarine tender located at Holy Loch on the River Clyde in Scotland. Several units with Poseidon missiles have been reassigned to the theatre nuclear role in support of NATO. Each American SSBN is assigned two crews designated Blue and Gold, one manning the vessel during a 70-day patrol and helping during the following 32-day minor overhaul before the other crew takes the vessel out on patrol. Every six years each boat undergoes a complete overhaul and reactor refuelling that lasts about 22-23 months. The individual submarines that comprise the two classes are the USS *Lafayette* (SSBN616), USS *Alexander Hamilton* (SSBN617), USS *Andrew Jackson* (SSBN619), USS *John Adams* (SSBN620), USS *James Monroe* (SSBN622), USS *Nathan Hale* (SSBN623), USS *Woodrow Wilson* (SSBN624), USS *Henry Clay* (SSBN625), USS *Daniel Webster* (SSBN626), USS *James Madison* (SSBN627), USS *Tecumseh* (SSBN628), USS *Daniel Boone* (SSBN629), USS *John C. Calhoun* (SSBN630), USS *Ulysses S. Grant* (SSBN631), USS *Von Steuben* (SSBN632), USS *Casimir Pulaski* (SSBN633), USS *Stonewall Jackson* (SSBN634), USS *Sam Rayburn* (SSBN635), USS *Nathaniel Greene* (SSBN636), USS *Benjamin Franklin* (SSBN640), USS *Simon Bolivar* (SSBN641), USS *Kamehameha* (SSBN642), USS *George Bancroft* (SSBN643), USS *Lewis and Clark* (SSBN644), USS *James K. Polk* (SSBN645), USS *George C. Marshall* (SSBN654), USS *Henry L. Stimson* (SSBN655), USS *George Washington Carver* (SSBN656), USS *Francis Scott Key* (SSBN657), USS *Mariano G. Vallejo* (SSBN658) and USS *Will Rogers* (SSBN659). Those from SSBN640 onwards are of the 'Benjamin Franklin' subclass.

Specification

'Lafayette' and 'Benjamin Franklin' classes

Displacement: 7,250 tons surfaced and 8,250 tons dived

Dimensions: length 129.5 m (425.0 ft); beam 10.1 m (33.0 ft); draught 9.6 m (31.5 ft)

Propulsion: one S5W pressurized water-cooled reactor powering two steam turbines driving one shaft

Speed: 28 kts surfaced and 25 kts dived

Diving depth: 350 m (1,150 ft) operational and 465 m (1,525 ft) maximum

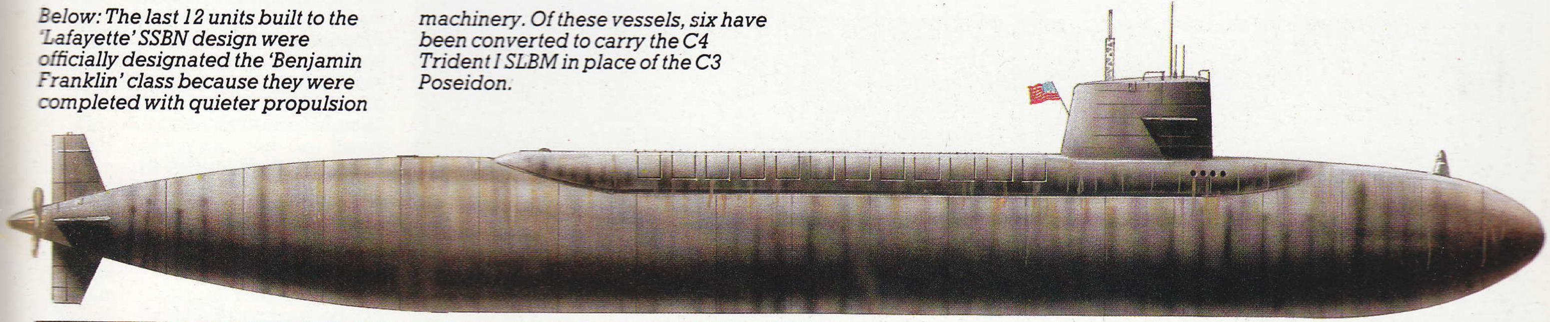
Armament: 16 launch tubes for 16 Trident I C4 (SSBNs 627, 629, 630, 632-634, 640, 641, 643, 655, 657 and 658) or for 16 Poseidon C3 (remainder) submarine-launched ballistic missiles, and four 533-mm (21-in) bow tubes for 12 Mk 48 ASW/anti-ship torpedoes

Electronics: one BPS-11A or BPS-15 surface-search radar, one ESM system, one BQR-7 sonar, one BQR-15 towed-array sonar, one BQR-19 sonar, one BQR-21 sonar, one BQS-4 sonar, and extensive communications and navigation systems

Complement: 140 ('Lafaytte') or 168 ('Benjamin Franklin')

Left: The C4 Trident I-equipped 'Benjamin Franklin' class vessel USS Mariano G. Vallejo *(SSBN658). Nowadays American SSBNs do not carry identifying pennant numbers for security reasons.*

Below: The last 12 units built to the 'Lafayette' SSBN design were officially designated the 'Benjamin Franklin' class because they were completed with quieter propulsion machinery. Of these vessels, six have been converted to carry the C4 Trident I SLBM in place of the C3 Poseidon.



USA

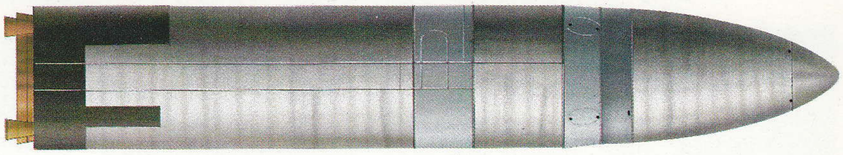
Lockheed UGM-73A Poseidon C3 SLBM

By 1964 two follow-on designs to the Polaris were under review. One subsequently evolved into the **Lockheed UGM-73A Poseidon C3** SLBM which could use the launch tubes of the existing fleet of SSBNs. Ultimately 31 out of the original 41 SSBNs built were refitted to carry the Poseidon, although some were later fitted to carry the Trident I. The Poseidon C3 entered operational service in 1970 after initial flight tests in 1968. The missile introduced the concept of MIRVing to American SLBMs. Up to a maximum of 14 Mk 3 independently targeted RVs (each with a yield of 40 kilotons) can be carried over a range of 4000 km (2,485 miles), but with the normal loading of 10 MIRVs the range is increased to 5200 km (3,230 miles). Penetration aids to confuse defence systems are also carried. The two-stage solid-propellant missiles are targeted mainly against soft military and industrial targets such as airfields, storage depots, and above-ground command and control facilities. A total of 619 operational missiles was bought, and 304 of these plus their 3,040 associated warheads are still afloat on the remaining 19 Poseidon-equipped SSBNs. Two or three Poseidon vessels are always assigned to the NATO high command for the theatre nuclear role in Europe and the Mediterranean. The Poseidon will eventually be replaced by the Trident II.

A C3 Poseidon SLBM just after launch. One problem for an SSBN commander is that he would prefer all his SLBMs to be launched in one go and not in several groups because each firing points to his location.

Lockheed UGM-73A Polaris C3 SLBM (continued)

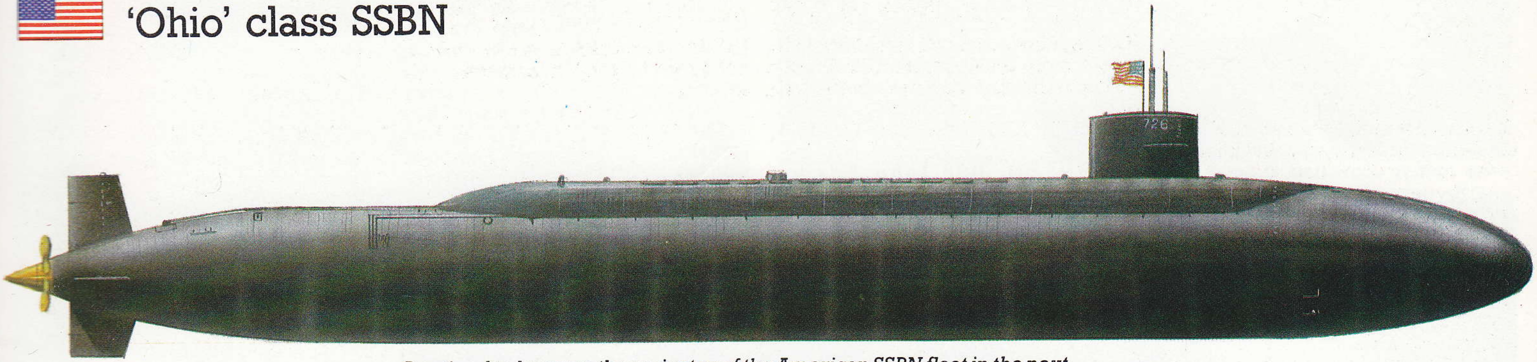
Specification
Poseidon C3
Type: submarine-launched ballistic missile
Dimensions: length 10.4 m (34.1 ft); diameter 1.9 m (6 ft 2 in)
Launch weight: 29030 kg (64,000 lb)
Performance: range 4000-5200 km (2,485-3,230 miles) depending on the number of MIRVs carried; CEP 553 m (605 yards)
Warhead: between 10 and 14 MIRVs each with a 40-kiloton weapon
Propulsion: solid-propellant rocket
Guidance: inertial



Still in service aboard 19 'Lafayette/ Benjamin Franklin' class SSBNs, the C3 Poseidon can carry up to 14 relatively low-yield warheads to attack independent targets.

USA

'Ohio' class SSBN

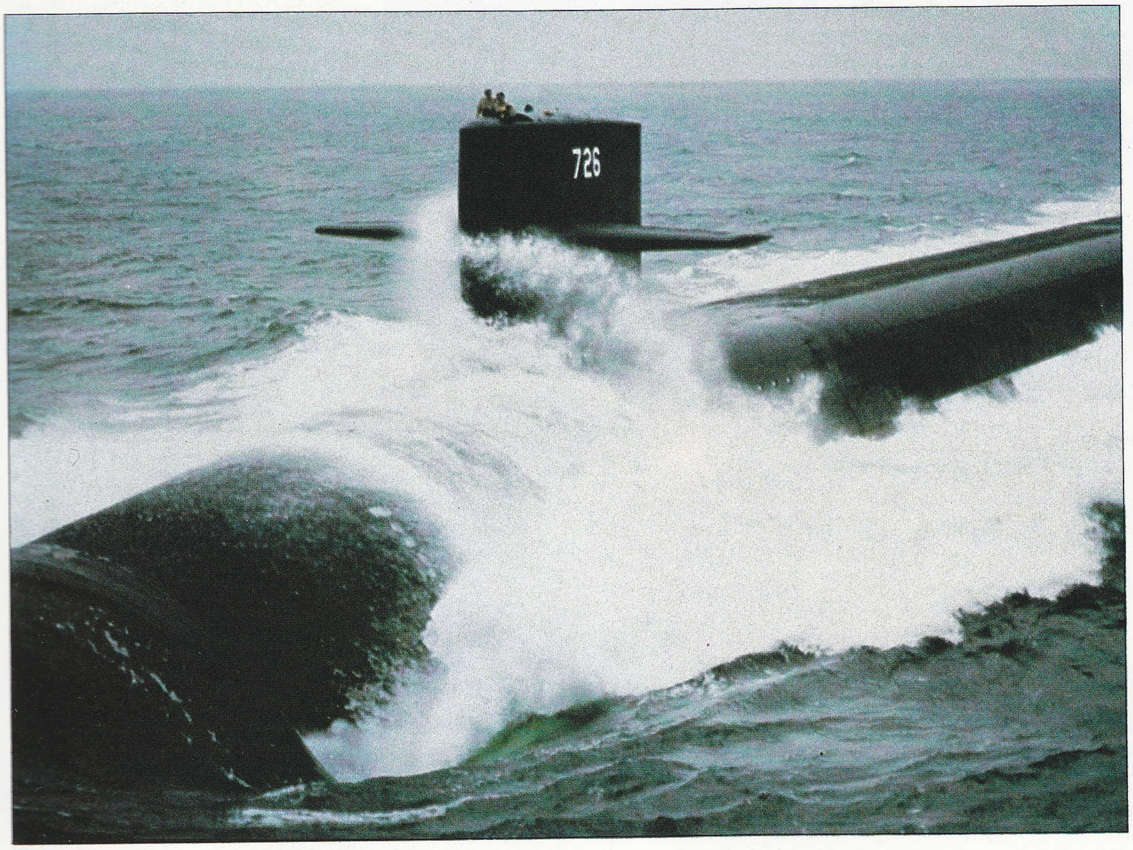


Destined to become the mainstay of the American SSBN fleet in the next decade and after, the 'Ohio' class will eventually carry the D5 Trident II SLBM that will allow these submarines to operate in patrol zones close to the American coasts, where they can be protected more easily.

Designed in the early 1970s as the follow-on SSBN to the 'Benjamin Franklin' and 'Lafayette' classes, the lead ship of the **'Ohio' class**, the USS ***Ohio*** (SSBN726) was contracted to the Electric Boat Division of the General Dynamics Corporation in July 1974. As the result of an unfortunate series of problems both in Washington, DC, and at the shipyard, the lead vessel did not run her first sea trials until June 1981, and was not finally commissioned until November of that year, three years late. Since then further delays have occurred in the programme but the rate of production is now beginning to get back on schedule.

Each submarine is expected to have a 12-month reactor refuelling refit every nine years and will work a patrol period of 70 days with the next 25 days spent alongside a tender or jetty readying for the next patrol. Because of their longer-range Trident missiles, the 'Ohio' class boats have patrol areas in the remoter parts of the world's oceans, making effective Soviet ASW measures against them virtually impossible for the foreseeable future, especially as the boats are acoustically very quiet.

At present four 'Ohios' are in commission: the *Ohio*, the USS ***Michigan*** (SSBN727), the USS ***Florida*** (SSBN728) and the USS ***Georgia*** (SSBN729). Six more are building: the USS ***Henry M. Jackson*** (SSBN730), USS ***Alabama*** (SSBN731), USS ***Alaska*** (SSBN732), USS ***Nevada*** (SSBN733) and two unnamed boats. At least another 11 are projected. The first eight are to be based in the Pacific at Bangor, Washington, whilst the remainder will go to the Atlantic Fleet at Kings Bay, Georgia, to replace Poseidon boats. From SSBN734 onwards the 'Ohios' will carry the Trident II missile in their 20 launch tubes whilst the others will be refitted at the first available opportunity.

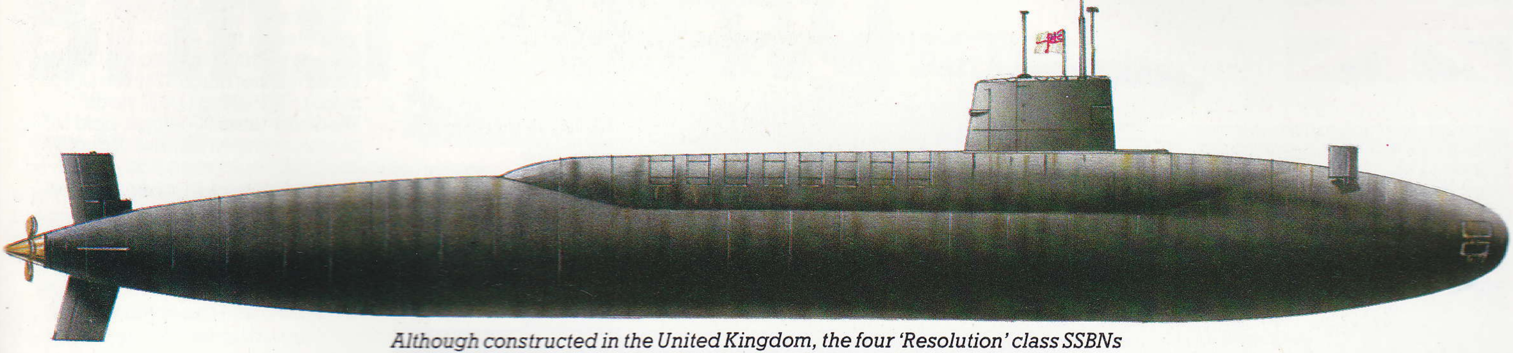


Specification
'Ohio' class
Displacement: 16,764 tons surfaced and 18,750 tons dived
Dimensions: length 170.7 m (560.0 ft); beam 12.8 m (42.0 ft); draught 10.8 m (35.5 ft)
Propulsion: one S8G pressurized water-cooled natural-circulation reactor powering a turbo-reduction drive to one shaft
Speed: 20 kts surfaced and 24 kts dived
Diving depth: 300 m (985 ft) operational and 500 m (1,640 ft) maximum
Armament: 24 launch tubes for 24 Trident I C4 submarine-launched ballistic missiles, and four 533-mm (21-in) bow tubes for an unknown number of tube-launched weapons
Electronics: one BPS-15A surface-search radar, one WLR-8(V) ESM system, one BQQ-6 sonar, one BQS-13 sonar, one BQS-15 sonar, one BQR-19 sonar, one BQR-23 towed-array sonar, and extensive communications and navigation systems
Complement: 133

The USS Ohio (SSBN726) under way. This class represents the latest in American technology, and is designed to defeat all foreseeable ASW threats that the Soviets are known to possess or believed to be capable of developing.

UK

'Resolution' class SSBN



Although constructed in the United Kingdom, the four 'Resolution' class SSBNs have a considerable amount of their internal systems based on American components that were used in the 'Lafayette' class.

HMS Revenge *(S27). In 1983 she became the second of Britain's Polaris submarines to operate with the upgraded Polaris A3TK Chevaline system designed to penetrate Soviet ABM defences around Moscow.*

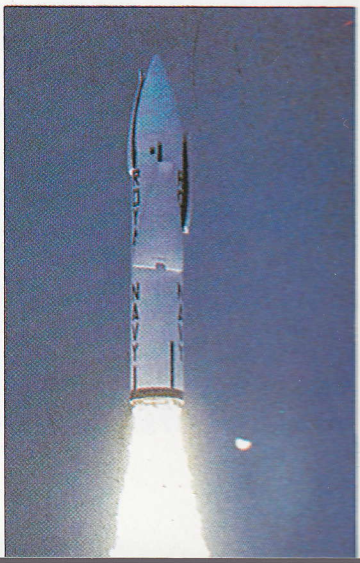
Officially stated in February 1963 was the British government's intention to order four or five **'Resolution' class** Polaris missile-equipped 7,000-ton nuclear-powered submarines that would take over the nuclear deterrent role from the Royal Air Force's V-bomber force from 1968 onwards. The first two pairs of boats were ordered in May 1963 from Vickers Shipbuilding Ltd, Barrow-in-Furness, and Cammell Laird & Co. Ltd, Birkenhead; the option on a fifth unit was cancelled in February 1965. With characteristics very similar to the American 'Lafayettes' the lead ship HMS ***Resolution*** (S22) was launched in September 1966 and commissioned in October of the following year. The second vessel, HMS ***Repulse*** (S23), followed in September 1968, with the third, HMS ***Renown*** (S24), and fourth, HMS ***Revenge*** (S27), commissioning in November 1968 and December 1969 respectively. Early in 1968 the *Resolution* sailed to Florida in the United States for missile launch trials, making the UK's first successful Polaris launch on 15 February. Four months later she sailed on her first deterrent patrol. As in French and American SSBNs, two crews (Port and Starboard) are used to maximize the time spent at sea, each patrol lasting around three months. When not aboard the crews take leave and undergo refresher training at the 10th Submarine Squadron base at Faslane on the Clyde. According to current plans the Polaris boats are to be replaced on a one-for-one basis from 1994 onwards by four 'V' class Trident II missile-carrying submarines. All four boats have recently undergone conversions during normal overhauls to carry the Polaris A-TK variant fitted with the Chevaline MRV warhead system.

Specification
'Resolution' class

Displacement: 7,500 tons surfaced and 8,400 tons dived
Dimensions: length 129.5 m (425.0 ft); beam 10.1 m (33.0 ft); draught 9.1 m (30.0 ft)
Propulsion: one pressurized water-cooled reactor powering two steam turbines driving one shaft
Speed: 20 kts surfaced and 25 kts dived
Diving depth: 350 m (1,150 ft) operational and 465 m (1,525 ft) maximum
Armament: 16 launch tubes for 16 Polaris A3TK submarine-launched ballistic missiles, and six 533-mm (21-in) bow tubes for an unknown number of tube-launched weapons
Electronics: one Type 1003 surface-search radar, one type 2001 bow sonar, one Type 2007 sonar, one Type 2023 retractable towed-array sonar, one ESM suite, and an extensive communications outfit
Complement: 135

USA/UK

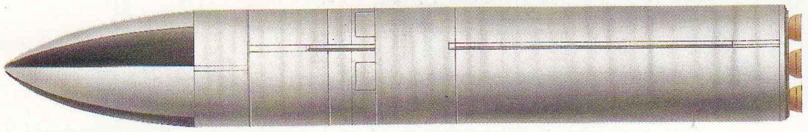
Lockheed UGM-27C Polaris A3 SLBM



Now used only by the United Kingdom, the Polaris A 3 SLBM is undergoing a rocket-motor replacement programme.

Now the sole user of the US-designed **Lockheed UGM-27C Polaris A3** SLBM, the Royal Navy has recently had its stockpile of Polaris missiles re-engined so that it can continue as the UK's nuclear deterrent force, with a range of 4748 km (2,950 miles). The British buy of the missile was, according to US Congressional records, 102 with another 30 purchased later to make up attrition. These were equipped with three British-designed and -built 200-kiloton yield MRVs for use against area targets such as cities and oilfields: the effect of a single high-yield warhead falls off rapidly with distance from the point of impact, whereas several smaller-yield weapons around the target perimeter cause significantly more damage. However, as a result of Soviet developments in ABM defences it was decided in the early 1970s that countermeasures would have to be built into the Polaris system. The result was the **Polaris A3TK Chevaline** project, which had its roots in a cancelled US warhead programme called Antelope. Chevaline involves the replacement of the 200-kiloton MRVs with three 60-kiloton weapons hardened against EMP and fast radiation, as well as the modification of the carrier bus to present defending radar systems with a confusingly large number of credible threats at the same time, with the result that the incoming warhead picture is swamped. Although not specified, these modifications are believed to include the fitting of chaff penetration aids and the possible carriage of decoys that on re-entry behave as real warheads do. The first submarine to be retrofitted with the new system was HMS *Renown*. As each boat comes in for refuelling she is converted to the new missile system.

Lockheed UGM-27C Polaris A3 SLBM (continued)



Equipping the 'R' class submarines of the Royal Navy, the Polaris A3 is the last model of the pioneering SLBM to remain operational.

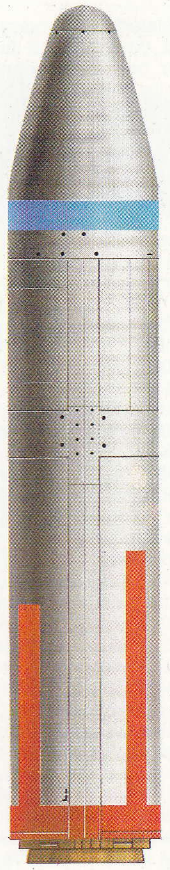
Specification
Polaris A3TK
Type: submarine-launched ballistic missile
Dimensions: length 9.8 m (32.2 ft); diameter 1.4 m (4 ft 6 in)
Launch weight: 15876 kg (35,000 lb)
Performance: range 4748 km (2,950 miles); CEP 930 m (1,017 yards)
Warhead: three 60-kiloton yield MRVs plus an unknown number of decoys and chaff penetration aids
Propulsion: solid-propellant rocket
Guidance: inertial

USA

Lockheed UGM-96A Trident I C4 SLBM

The purpose of the **Lockheed UGM-96A Trident I C4** missile development programme was essentially to increase the range of American SLBMs to allow the use of larger and remoter patrol areas. A three-stage solid-propellant missile, the Trident I was flight tested in 1977, becoming operational two years later aboard the SSBN conversions of the 'Benjamin Franklin' and 'Lafayette' classes. The first two stages of the missile are essentially the same as those fitted to the earlier Poseidon C3 SLBM, but the third stage is fitted with stellar-inertial guidance to give the required accuracy over the longer range. The first eight 'Ohio' class SSBNs are being fitted to carry the Trident I, but these will eventually be retrofitted to carry the yet longer-ranged Trident II in the early 1990s. Rapid onboard targeting to another pre-planned target coordinates package is possible, but a far lengthier operation is required if the system has to be fed new target coordinates from an external source. As increased range was considered to be more important than accuracy improvement, a CEP comparable with that of the Poseidon was accepted. The use of higher-yield warheads, however, allows more hardened military and industrial targets to be engaged on a satisfactory basis than was possible with the earlier missile, and as such it is believed that one Trident-equipped submarine will have its re-entry vehicles assigned to NATO for use in the theatre nuclear role. A total of 740 missiles is to be procured, with eight MIRVs per missile. Eventually, in the next century, the American SSBN force will be a mix only of 'Ohio' class boats with Trident II missiles.

At enormous cost, the Trident programme will provide the seaborne element of the US strategic deterrent for the foreseeable future. Trident I employs the 7400-km (4,600-mile) ranged C4 missile, which will eventually be replaced by the D5.



Fitted to 12 of the 'Lafayette/ Benjamin Franklin' class SSBNs and the new 'Ohios', the C4 Trident 1 SLBM proves the nearest American equivalent to the long-range Soviet SLBMs but with more accurate payloads of MRV warheads.

Specification
Trident I C4
Type: submarine-launched ballistic missile
Dimensions: length 10.4 m (34.1 ft); diameter 1.9 m (6 ft 2.8 in)
Launch weight: 31751 kg (70,000 lb)
Performance: range 6808 km (4,230 miles); CEP 549 m (600 yards)
Warhead: eight MIRVs each with a 100-kiloton weapon
Propulsion: solid-propellant rocket
Guidance: stellar-inertial

USA

Lockheed Trident II D5 SLBM

The **Lockheed Trident II D5** is the result of an improved accuracy programme for American SLBMs begun in Fiscal Year 1975. Scheduled for operational deployment on 'Ohio' class SSBNs from the ninth vessel onwards in December 1989, the Trident II will be more accurate and have the ability to carry a greater number of larger-yield warheads than its predecessor, the Trident I. The accuracy will be sufficient to make feasible the targeting of Soviet hardened underground missile silos and command bunkers. This will be the first time ever that American sea-based strategic forces will have had the capability to attack any Soviet target type. In addition to the Trident II the programme is aimed at increasing the number of warhead vehicles available to something like the total at the height of the Poseidon programme, but with greater megatonnage to match Soviet increases. A minimum of 857 missiles will be procured for the 20 or more 'Ohio' class submarines.

A further batch of around 100 (to be serviced in the USA) will be procured by the UK, as in 1982 it was decided that this missile would be adopted for the new 'V' class submarines that are to replace the Polaris boats in the mid-1990s. The British missiles will differ in that they will carry only eight lower-yield MIRVs designed and built by the Atomic Weapons Research Establishment and Royal Ordnance Factories. This lower number of lighter warheads will allow the missiles to be fired over even longer ranges than the US versions.

Specification
Trident II D5
Type: submarine-launched ballistic missile
Dimensions: length 13.96 m (45.8 ft); diameter 1.89 m (6 ft 2.4 in)
Launch weight: 57153 kg (126,000 lb)
Performance: range 7400-11100 km (4,600-6,900 miles) depending on number of MIRVs carried; CEP 92.5 m (101 yards)
Warhead: between eight and 14 MIRVs each with a 375-kiloton weapon
Propulsion: solid-propellant rocket
Guidance: stellar-inertial

Armed Forces of the World

British Army

Part 4

The shape of AAC equipment in the future? This Pilatus Britten-Norman Islander has recently been displayed under the acronym CASTOR (Corps Airborne Stand-off Radar) in an attempt to meet the army's battlefield reconnaissance requirements.

Army Air Corps

The Army Air Corps has five main roles, namely observation and reconnaissance, armed action in the anti-tank role, direction of artillery fire, command and control for land-based units, and movement of men and material (to a limited degree only).

To carry out these duties within BAOR the Army Air Corps is organized into army aviation regiments. Each of these regiments (there are basically three) is part of an armoured division establishment, and comes directly under the control of the armoured division headquarters. Each regiment has two squadrons, one equipped with Westland Lynx helicopters and the other with Aérospatiale Gazelles.

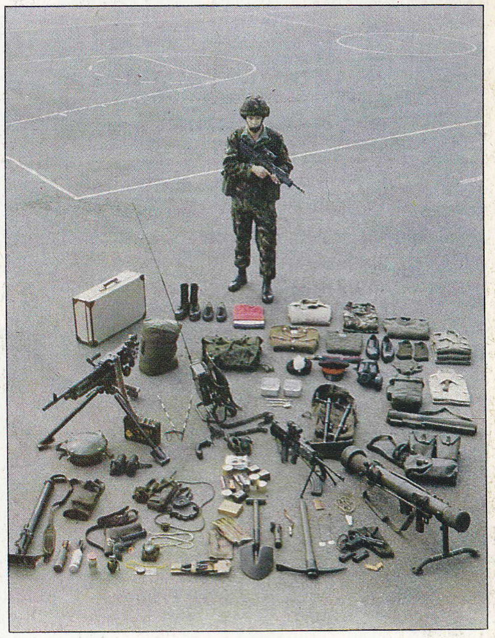
The Lynx squadron has a basis of 12 helicopters, but this might vary in some squadrons. The Lynx is charged with the anti-tank role and is equipped with up to eight TOW anti-tank guided missiles. TOW is an American wire-guided missile with a maximum range of 3750 m (4,100 yards) and weighing approximately 24 kg (52.9 lb). This makes the TOW a very powerful anti-tank weapon and the Lynx/TOW combination is regarded as among the best anti-tank weapon systems in use in NATO. The Lynx helicopter crews have developed special anti-tank tactics and frequently train with their equivalents from other NATO nations.

The Gazelle's main combat use is artillery observation and spotting, but it also has an important liaison role and is frequently used by senior commanders as a mobile command post. One squadron of Gazelles is deployed at I (BR) Corps level for just this role. The Gazelle is also widely used at all levels for general reconnaissance.

The Lynx can carry a crew of two and up to 10 soldiers, although it is not intended that it will often be used for the troop-carrying role, a task undertaken for the army by the Royal Air Force. The Lynx is a fairly large helicopter with a fuselage length of

This Westland Lynx AH.Mk 1 sports a full complement of eight Hughes TOW ATGMs. An additional six to eight missiles can be carried in the cabin for re-arming and a wide range of other weapons is available.

12 PASS



11.665 m (38.27 ft), but it is fast and manoeuvrable. In the anti-tank role Lynx helicopters normally operate in pairs.

In contrast Gazelles tend to operate individually. Apart from the pilot the Gazelle can accommodate only four passengers, and no armament is carried. In place of the seating special equipment such as night-vision devices can be carried, and it is possible to use the Gazelle as a flying ambulance.

In the United Kingdom some army aviation squadrons continue to use the Westland Scout helicopter, and the one army aviation squadron to be formed in the Territorial Army will also use the Scout. The Scout is a sturdy multi-purpose helicopter that at one time used the AS.11 wire-guided missile for the anti-tank role, but this has now been assumed by the Lynx/TOW combination. At various times machine-guns have been fitted to the Scout, either on over-skid mountings or on pintles to be fired from the main cabin.

The only other helicopter used operationally by the Army Air Corps is the Aérospatiale Alouette AH.Mk 2. This is now used in small numbers only (about eight all told) for liaison and the carriage of VIPs, but most of the Alouettes are based in Cyprus for use with the UNIFCYP forces.

The Army Air Corps uses only one type of fixed-wing aircraft for operations, and that is the venerable de Havilland Canada Beaver AL.Mk 1. This is used for a variety of purposes that range from small-scale supply dropping to general communications. They can be used for photographic reconnaissance and casualty evacuation, and have been fitted with loudspeakers for 'voice from the sky' purposes. There is no definite establishment for the Beaver as they are deployed as and when required. About eight are left in service, some of them in Northern Ireland and at least one at the BATUS training area in Canada.

Middle Wallop in Hampshire is the main base for the Army Air Corps and also acts as the corps' training base. For flying training de Havilland Chipmunk T.Mk 10s are used for basic training, followed by Bell 47Js for basic helicopter training; these Bell 47Js are operated under contract with a civilian organization. For advanced training Lynxes and Gazelles are used.

The Army Air Corps operates about eight Beavers, about 20 Chipmunks, about 40 Scouts, eight Alouettes, 155 Gazelles and approximately 80 Lynxes, not all of which are fitted for TOW.

A busy scene at the Army Air Corps base, Middle Wallop, as three Gazelle AH.Mk1s prepare for operations. The nearest machine, XW885/B, is operated by the Advanced Rotary Wing School (ARWS), as indicated by the Day-Glo patches, while the two in the background are from BAOR.

British Army order of battle

29 headquarters units
12 armoured regiments
7 armoured reconnaissance regiments
53 infantry battalions (including 6 Ghurka battalions)
3 parachute battalions (only 2 in para role)
1 Special Air Service regiment
1 missile regiment (Lance)
3 air defence regiments (Rapier).
17 artillery regiments
1 locating regiment
4 independent anti-tank units
10 engineer regiments
1 armoured engineer regiment
1 amphibious engineer regiment
1 independent engineer squadron
4 army aviation regiments

The equipment of the modern British infantryman: on the left, the GPMG on a tripod for the sustained fire role; on the right, a Carl Gustav RR and a LAW. The soldier himself sports the new pattern helmet and carries the Enfield 5.56-mm Individual weapon.

Territorial Army order of battle

2 infantry brigades
5 armoured reconnaissance regiments
35 infantry battalions
2 Special Air Service regiments
2 field artillery regiments (Light Gun)
3 light air defence regiments (Blowpipe)
7 engineer regiments
1 army aviation squadron
11 battalions Ulster Defence Regiment

A true workhorse during the Falklands war, and currently replacing the Lynx in the garrison Army Air squadron, the Westland Scout AH.Mk 1 is seen here transporting troops during the conflict. Note the stabilized optical tracking sight above the cockpit for use with the Nord AS.11 air-to-surface missiles.